CRL Report 7: Conserving the hull of the *Belle*

La Salle Shipwreck Project
Texas Historical Commission

Throughout each year, the Conservation Research Laboratory conserves material from a number of different archaeological projects. The purpose of these CRL reports is to showcase the conservation procedures used to treat some of the more interesting archaeological material. The reconstruction of the *Belle*'s hull is presented in this report. The *Belle*, one of the ships of French explorer Robert Cavelier, Sieur (Lord) de La Salle, was lost in Matagorda Bay, Texas in 1686. It was excavated by the Texas Historical Commission.

Ship Hull Conservation

The excavation of the *Belle* by the Texas Historical Commission in 1996/97 was one of the most innovative and spectacular archaeological excavations of the decade. The THC took an underwater site and made it a land (more or less) excavation by constructing a cofferdam around the ship and pumping out the water. The finds on this fully loaded *barque longue* (frigate) belonging to the famous French explorer La Salle were nothing less than amazing. There is a massive array and quanity of material.

The single largest artifact is the remains of the ship herself. It is estimated that approximately one-third of the ship survived. The remains of the ship were dissassembled in the field, and some 764 components (keel, keelson, frames, ceiling planking, mast step, pump box, outer planking, etc.) were sent to the Conservation Research Laboratory at Texas A&M University for conservation. Because of the importance of this shipwreck, we are making equally innovating approaches in the conservation of the hull.

The complete conservation of the hull is being documented on this web site. It is proceeding in several stages:

- **STAGE 1:** Proper storage and cleaning of the wood in preparation for reassembly
- **STAGE 2:** Construction of the concrete vat by C.F. Jordan Construction of College Station, Texas
- **STAGE 3:** Construction of the lifting frame by Dynacon of Bryan, Texas
- **STAGE 4:** Vat construction completed. The vat was viewed by all interested parties at an Open House on November 12, 1999. Reassembly of the hull completed in October 2001.
- **STAGE 5:** The conservation of the hull begins. **This is where we are now!**

- **STAGE 6:** When the conservation of the hull is completed, it will be removed for final preparation for exhibition.
- **STAGE 7:** The preserved hull will be partially disassembled and shipped to a museum where it will be displayed.

Photo Galleries

Stage 1 – Planning

PHOTO GALLERY 1: MAY 1997 - AUGUST 1, 1998

The first order of business was to store the hull components until the timbers could be cleaned and documentated. The *Belle* was stored in a 'sea of vats' on the edge of a World War II runway in front of the Conservation Research Laboratory - Projects Facility. The laboratory occupies the former firehouse of the Bryan Air Force Base. The base is now a research facility of Texas A&M University called Riverside Campus.

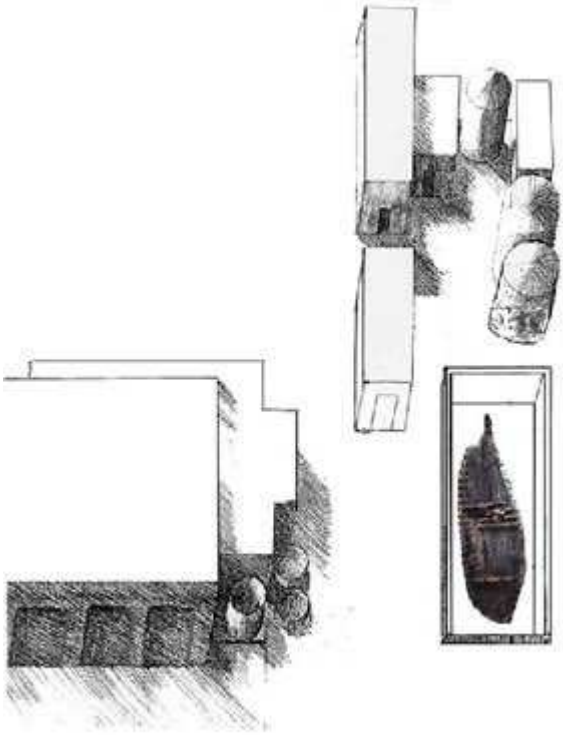
The component parts of the hull of the *Belle* are stored in a 'sea of vats' on the edge of the runway in front of the Conservation Research Laboratory - Projects Facility at Riverside Campus, Texas A&M University.

The 381 component pieces of the ship's hull are kept immersed in water in a variety of storage vats, including two large vats donated by BFI, Inc. If the pieces of the hull are not kept wet, they will eventually warp and crack.

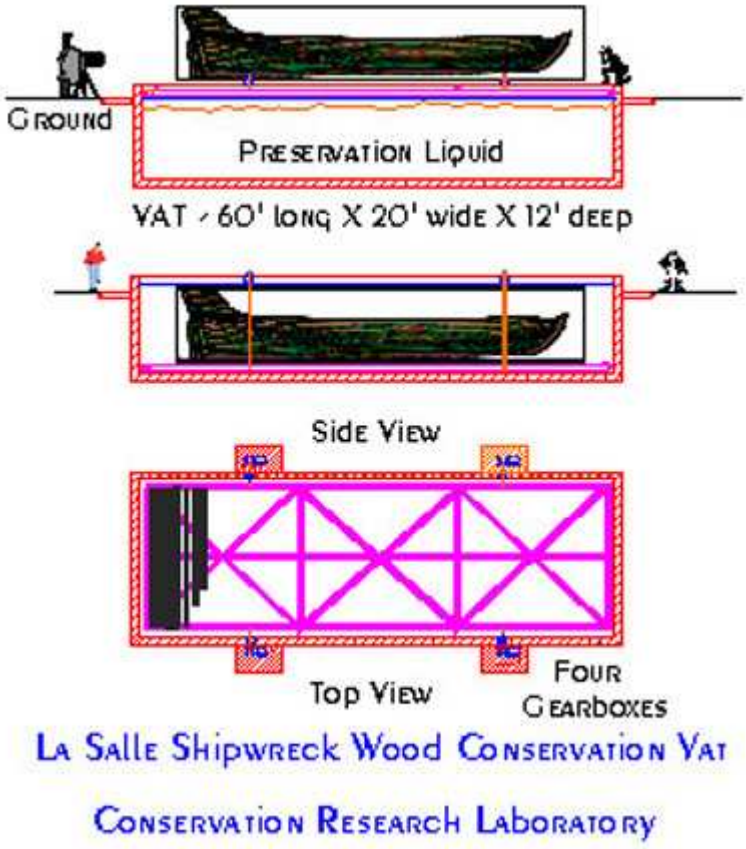
The vats are uncovered for this photograph.

Conservator Peter Hitchcock uses a Chicago Pneumatic Air Scribe® to remove concretion, iron bolt fragments, and the remains of wood trunnels from a frame. Cleaning is required before the hull can be reassembled.

This area beside the Conservation Research Laboratory- Projects Facility will be the location of the new wood conservation vat. When the concrete vat is completed, the hull of the *Belle* will be reassembled in it before starting the conservation.



Plan view of the wood conservation vat under construction. Note the remains of the *Belle,* with the bow at the top, are placed to scale inside the vat. This is how the ship will look once it is reassembled inside the vat. The hull will sit on a platform supported with a scaffolding system. The platform will be able to be lifted up and down so that work can be done on the hull more easily.



The AutoCad® drawing to the left is just schematic and does not show the actual architectural details. It does, however, show the basic features, such as the frame in the vat that is attached to four motorized gear boxes that will lift the assembled ship up out of the solution. This will greatly facilitate the reconstruction and will allow us to monitor and document the preservation process once it gets underway.

Chemical storage tanks donated by Loeb Construction. These will be mounted in the back of the wood conservation vat to hold the chemicals that will be used in treatment.

Stage 2 - Vat Construction

PHOTO GALLERY 2: AUGUST 8 - AUGUST 30, 1998

August 8, 1998. Mr. Jim Jobling, Project Manager of the Conservation Research Laboratory, and Dr. Donny Hamilton, Director of the Conservation Research Laboratory and the Head of the Nautical Archaeology Program, got up early on this Saturday morning to ceremonially break ground for the construction of the concrete vat to be used to conserve the hull of the *Belle.*

The large backhoe arrived early and started to remove the concrete slab lying adjacent to a WWII air control tower that is long gone. However, the four buried leg supports would be encountered soon enough.

Going through the small concrete slab of a former WWII building is an easy task with the right equipment.

Two dump trucks were kept busy hauling off the estimated 650 cubic yards of clay and sand that was removed from the excavation.

Removing one of the two concrete supports that were once the base of the control tower. The concrete support has a base 7 ft. sq. x 2 ft. thick and a 3 ft. sq. x 3 ft. high pyramid that comes to a 2 ft. sq. top. We calculated its weight to be in the range of 17,000 lbs. The backhoe managed to get the support out and off to one side. However, we have not found anyone handy who can remove them. They are up for grabs, free to anyone who

will pay the shipping charges. Otherwise, I guess the two of them will remain as permanent markers, or perhaps bases for statues.

The excavation of the pit was finished on Monday, August 10, 1998, and after doing some basic cleaning up by hand, work began on installing the 15 tons of reinforced steel!

Note the two cross trenches, which will form the large U-shaped bracing, which will encircle the vat. This will provide support for the winch gear boxes, which will lift the frame holding the reaseembled hull of the *Belle* as it undergoes conservation.

Texas A&M University nautical archaeologists take credit for breaking the drought on August 13, 1998, that has ravaged most of the state for the past six months.

Even in a drought, dig a hole, and watch the rain come. Needless to say, the rain brought all work to a halt and put off the completion date.

August 16, 1998. After a deluge of rain and two days of cleaning out the mud, workers began installing the reinforcing rods for the floor and lower walls. Plastic sheets were left on the sides of excavation to protect the wall during the intermittent rain that continued to fall.

August 17, 1998. It took a continuous convoy of eight concrete trucks (18 truck loads) to keep the hopper of the concrete pumper truck filled to spread the 160 cubic yards of concrete needed for the floor of the vat.

August 18, 1998. The floor is successfully poured, and now work will start on forming the walls so they can be poured. Once the concrete is firmly set, work will begin on building the forms for the 12 ft.-high walls.

The work should progress quickly if the weather and the rain cooperates.

PHOTO GALLERY 3: SEPTEMBER 1 - 11, 1998

With the successful pouring of the bottom slab, workers begin adding the reinforcing steel rods up to the full 12 ft. height of the wall.

The reinforcing steel rods are interlocked to form a secure mesh inside the walls of the vat.

Once the reinforcing steel is in place, the forms for the wall are put in place and secured with braces in preparation for pouring the concrete.

Forms being installed inside the vat.

September 9, 1998. Pouring the concrete to form the walls of the vat.

Packing and vibrating the wall to make sure the concrete fills the forms properly.

September 11, 1998. The walls are poured just in time for the tropical depression Frances to arrive on the scene and start several days of rain. Still to be constructed are the four projecting pads coming off of the four pillars. The pads will support the four motorized gear boxes, which will lift the frame that will support the hull during assembly and conservation.

C.F. Jordan, Inc. of College Station, Texas, is responsible for the design and construction of the vat.

PHOTO GALLERY 4: OCTOBER 16, 1998

C.F. Jordan, Inc. completed the construction of the vat
on October16, 1998. Still remaining is the compaction of soil around the wall, so a concrete pad can be poured around the vat.

The 8-in. PVC pipe at the end of the vat is part of a French drain to keep the ground water level around the vat down below the bottom of the vat. The four massive concrete extension are platforms for mounting the four electric motors and gear boxes to power the cable to lift the frame with the hull of the *Belle* on it.

Left: A shot of the interior of the vat clearly demonstrating
its size and depth.

Revised Schedule:
The present schedule is to start constructing the lifting frame in early 1999. Reconstrucion of the hull of the *Belle* is scheduled to begin in the summer of 1999.

The lifting frame that will be placed in the bottom of the vat is in the process of being designed by Dynacom of Bryan, Texas. It will be partially fabricated at their local plant, and the pieces will then be trucked to the Conservation Research Laboratory for the construction to be completed inside the vat. The electric motors, gear boxes, pulleys, and lifting cables will be installed at that time on the four cantilevered concrete projections along side the vat.

Right: the observation platform on top of an adjacent building.

The concrete slab surrounding the vat will provide easy access to the vat with a forklift or a crane. In the near future, a 6-ft. tall chainlink fence will be constructed around the wood conservation vat area.

The top of the building in the background will be used as an observation platform for visitors and for an elevated photographic stand.

Note the cantilever platforms projecting from the sides of the vat on which the four gearboxes will be mounted to raise the frame and the hull of the *Belle* once it is reconstructed on the frame inside the vat.

The wood conservation vat was designed and constructed by C.F. Jordan, Inc. of College Station, Texas.

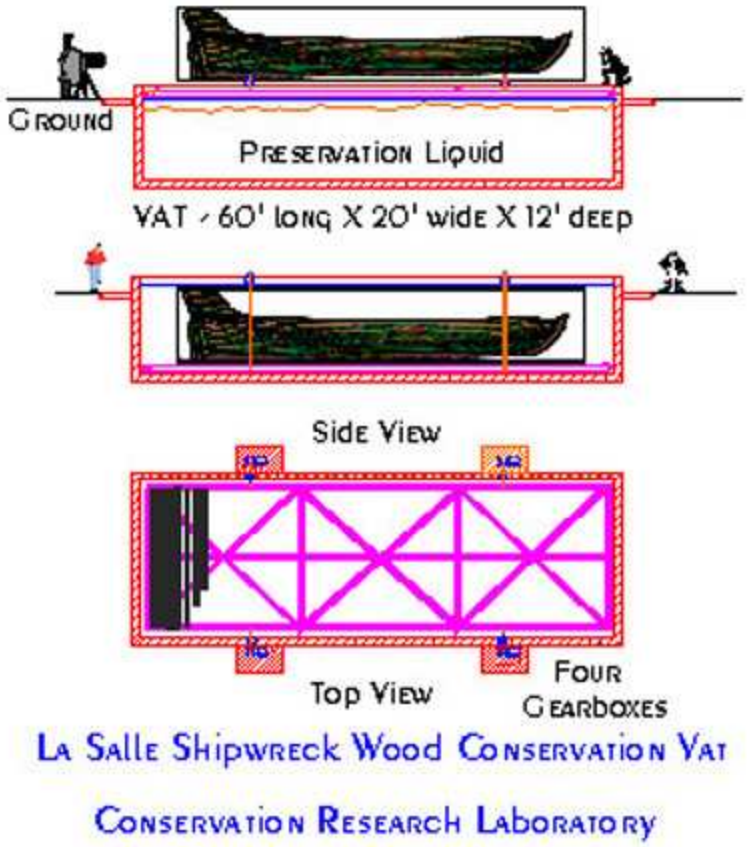
C. F. Jordan, Inc.

Stage 3 - Lifting the Frame Construction

PHOTO GALLERY 5: MAY 13, 1999

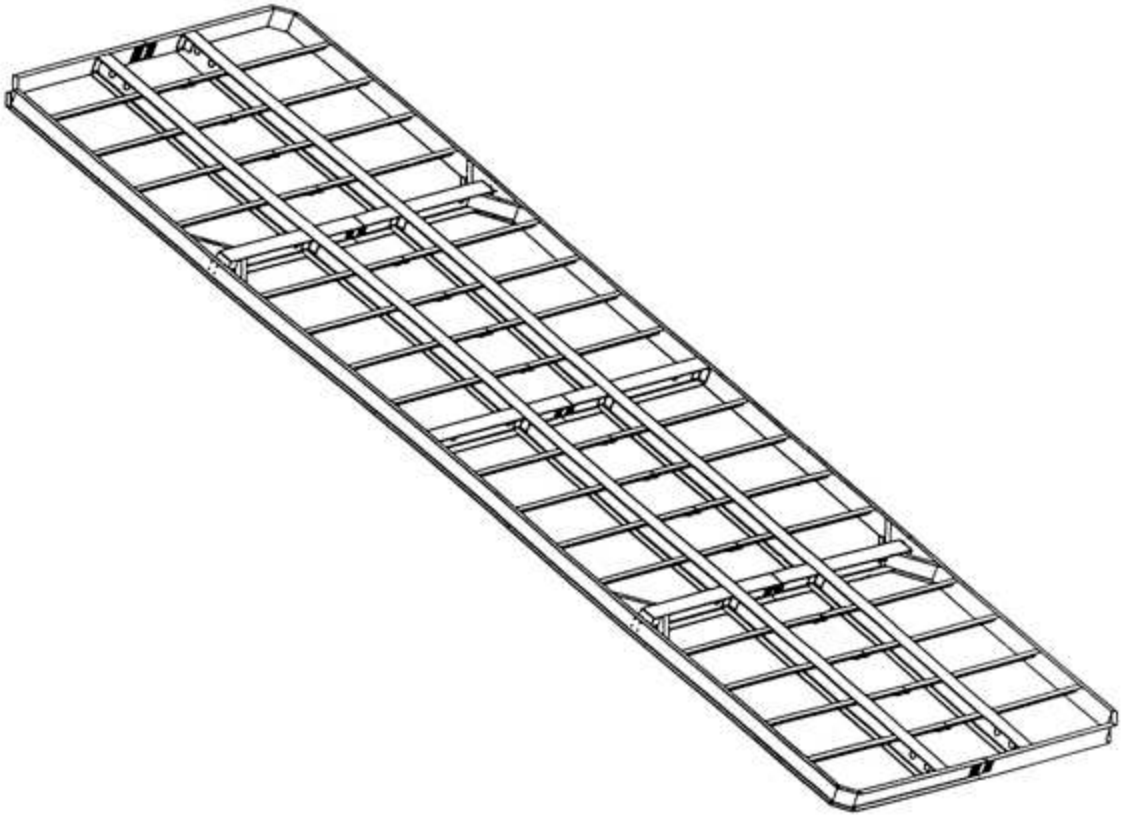
DYNACON, INC.
Winches & Handling Systems
For The Ocean Industry

The lifting frame is in the process of being designed by Dynacom, of Bryan, Texas. It will be partially fabricated at their plant in Bryan, and the pieces will then be trucked to the Conservation Research Laboratory, where the construction will be completed inside the vat. The electric motors, gear boxes, pulleys, and lifting cables will also be installed at that time.



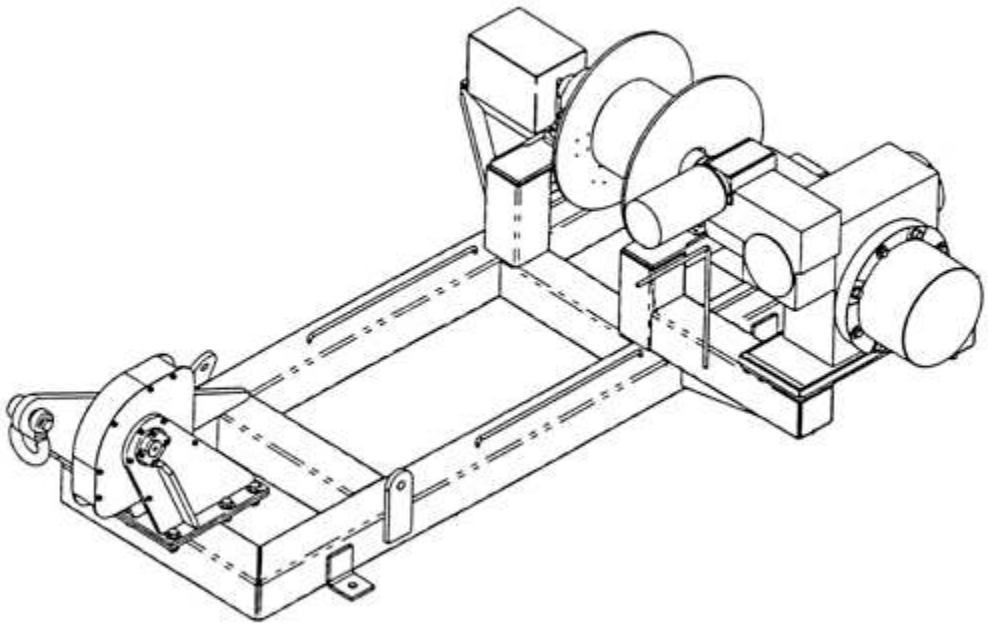
Schematic and stylized design of the proposed wood conservation vat, the lift, the four gear boxes, and the reconstructed hull of the *Belle.*

The frame will support the hull and will raise it out out the vat as required.



The specially designed frame that will support the hull of the *Belle* while it is being reassembled and conserved. The frame is designed so that will support 40,000 lbs. and will not deflect over one inch along its length when lifting the hull.

One side of the lifting frame is being welded together in the Dynacon, Inc. shop in Bryan, Texas.



One of the four gear boxes designed by Dynacon, Inc. of Bryan, Texas, to lift the frame to the top of the wood conservation vat.

PHOTO GALLERY 6: JUNE 22, 1999

The lifting frame is designed by Dynacom of Bryan, Texas. It was partially fabricated at their plant in Bryan. The two halves were then trucked to the Conservation Research Laboratory, where they were bolted together inside the vat.

The electric motors, gear boxes, pulleys, and lifting cables will be installed in the near future.

DYNACON, INC
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Crane operator, Mr. Gerald Kirkland, owner of Kirkland Crane, Inc., in Bryan, Texas, lifts the first half of the lifting frame off the truck and lowers it into the conservation vat.

The frame will support the hull and will raise it out of the vat as required**.**

The second half of the lifting frame is laid alongside the first half. The frame is specially designed to support the hull of the *Belle* while it is being reassembled and conserved. The frame is designed so that it will support 40,000 lbs. and will not deflect over one inch along its length when lifting the hull.

Laboratory assistants Dan Walker, Jim Jobling, Peter Fix, and Peter Hitchcock bolt the two halves of the frame together.

PHOTO GALLERY 7: SEPTEMBER 1999

DYNACON, INC.
Winches & Handling Systems
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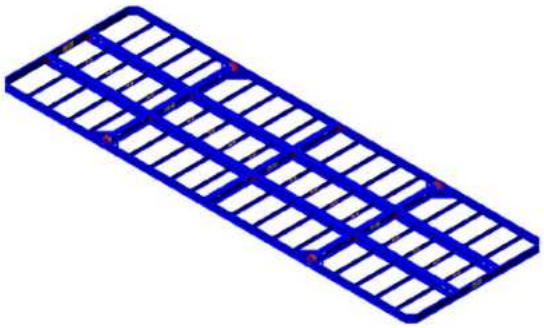
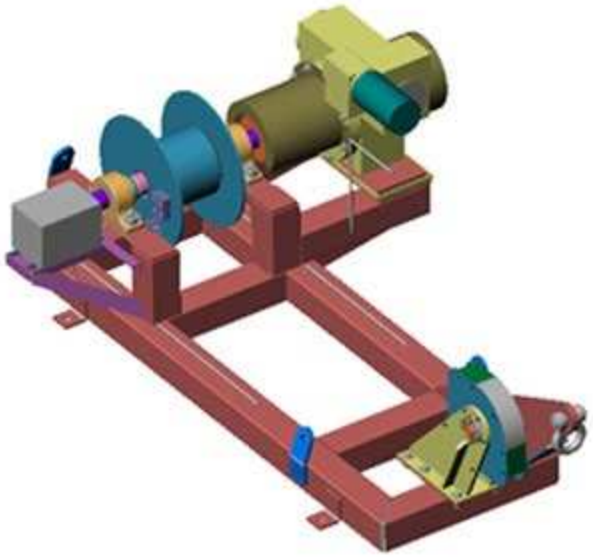
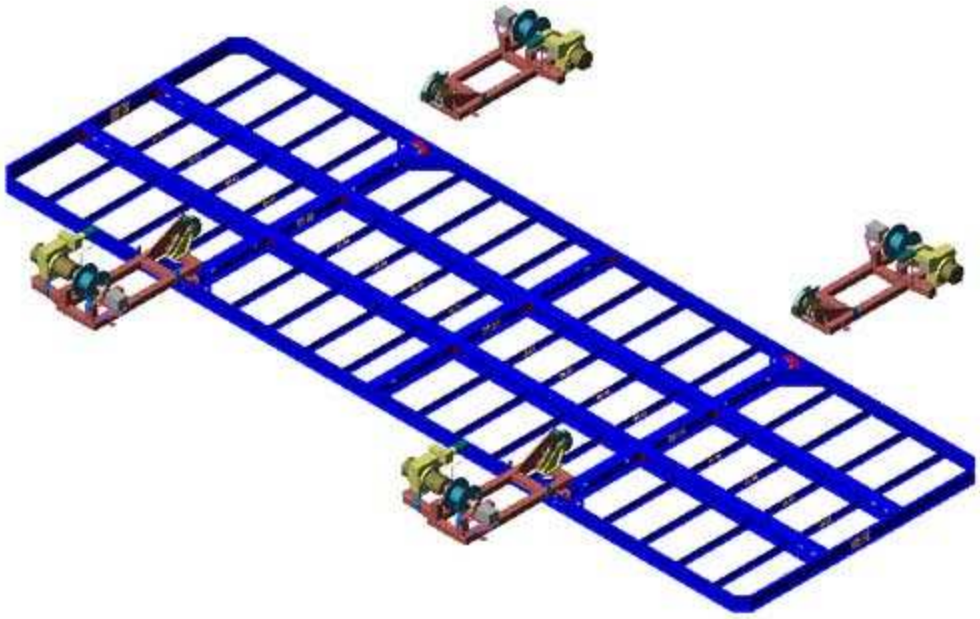
The following designs were prepared by Dynacon, Inc. for the lifting platform and the four winches that will lift the ship out of the conservation vat during the reassembly phase and during the actual conservation of the hull.



The steel platform that serves as the lifting frame is designed to lift 40 tons and will not deflect over one inch over the 60-ft. length during the lift.



Each of the four winches can safely lift 12 tons and is secured to massive support platforms situated over a cantilever beam that goes down the sides and bottom of the vat, connecting the two opposing winch platforms. The thickened beams going down the sides and under the vat ensures that no pressure will be exerted on the vat's walls.



Schematically, the four winches are positioned over and around the lifting platform.

PHOTO GALLERY 8: OCTOBER 1999

The CRL wood conservation vat is well on its way to being completed. The vat is the largest wood conservation facility in the United States. For that matter, it is the largest wood conservation vat in the world that conserves wood by immersion. The vat incorporates a number of features, such as the lifting platform, not found in any other vat. Our intent is to reassemble the *Belle* prior to its conservation to ensure that it goes together properly.

Installing one of four winches

Installing the fiberglass grating on the lift

The keel and keelson of the *Belle* are placed in the wood conservation vat to be cleaned prior to reassembly

Using the water to reduce the weight, the staff turn the keel over to clean the other side

Cleaning the keel prior to reassembly and conservation

Working this way is fine in the hot summers and the warm fall, but what about winter?

Sometimes it's necessary to get really close to your work to get all of the crud out of the holes and the junctures in the keel.

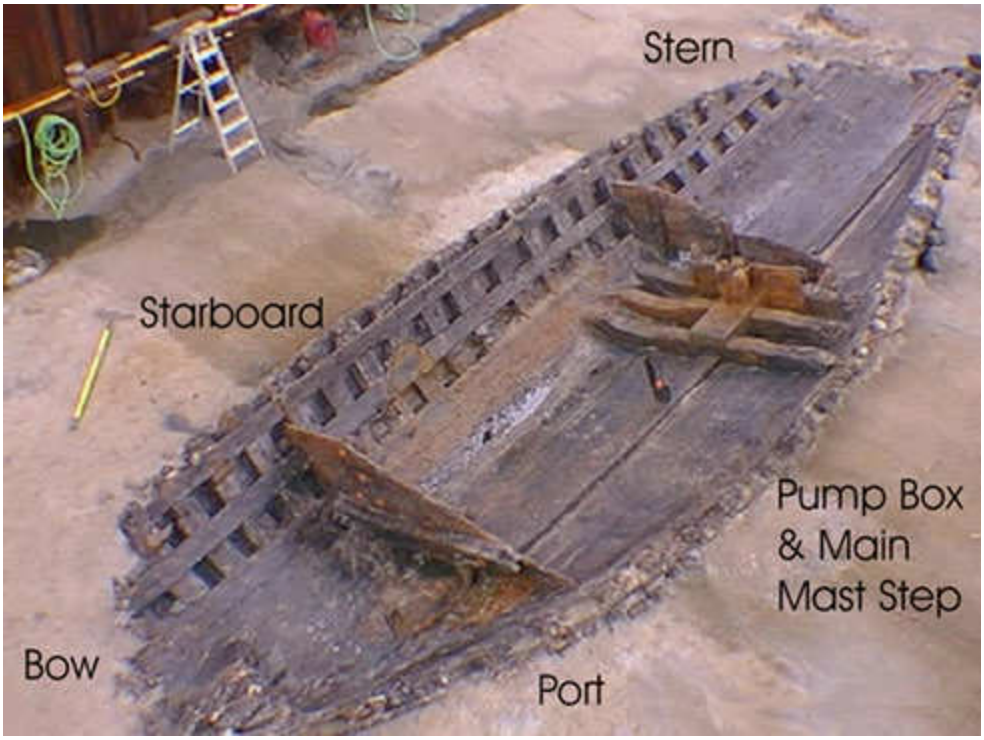
Once the keel and the keelson were cleaned, the lift was raised to remove the keelson, since it will not be needed for some time.

It's easy to see that a variety of equipment is necessary to move these delicate timbers safely. Our small forklift is fine for many jobs, but at times, it's necessary to call on the Texas Transportation Institute - to bring in the 'Big Guy' for moves such as this.

Stage 4 - Reassembling the Hull of *La Belle*

PHOTO GALLERY 9: THROUGH SUMMER 2000

So what have we been doing for the last year??

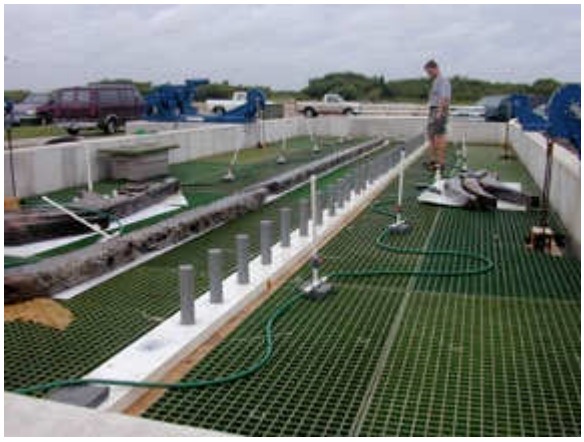


The *Belle*, as she lay in the cofferdam

Cleaning the timbers to remove all surface encrustation and remnants of the treenails and iron fasteners.

Recording the timbers.

PHOTO GALLERY 10: THROUGH SUMMER 2000



Preparing to place the keel on the support pillars on the steel back

Using the water to displace the weight of the keel in order to place it on the molded shoe that matches the erosion on the keel's underside.

The keel is positioned on the fiberglass shoe, which runs along the bottom length of the keel. The keel and support shoe are then placed on to the pedestals. The pedestals are fastened to the steel back on the frame.

Placing the frames on the keel floors.

Carefully aligning each frame with the hull lifted out of the water.

Carefully aligning each frame with the hull partially submerged in the water. Note the spray which is used to keep the hull wet when it is out of the water.

PHOTO GALLERY 11: AUGUST-SEPTEMBER 2000

Lab assistants position additional timbers using the water to displace the weight of the timbers. Obviously, this is being conducted during the summer.

A lab assistant attaches the lower part of a frame with a threaded fiberglass rod.

Most of the frames are now attached.

View from the stern.

View across the frames, looking to starboard.
Note the padded supports and the fiberglass rods.

A lab assistant works on the frames in the bow.

PHOTO GALLERY 12: OCTOBER 2000

Using a large forklift and spanner bar to place the keelson in the vat.

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Lab assistants use the weight of the water to displace the weight of the keelson so that it can be placed in position and the frames more carefully aligned.

The proud ship reconstructors:
Peter Hitchcock, Taras Pevny, and Peter Fix.

The ship as assembled prior to forming the underlying support plates for each frame set.

View from the bow of the assembled frames.

Note the supports being used to support the frame sets. Once the support plates are positioned on each frame set, the ship will be able to stand with minimal external supports while on display.

PHOTO GALLERY 13: NOVEMBER 2000

A frame set is positioned on the molding frame so that a carbon fiberglass composite plate can be cast.

Preparing the vacuum bag to make the frame plate.

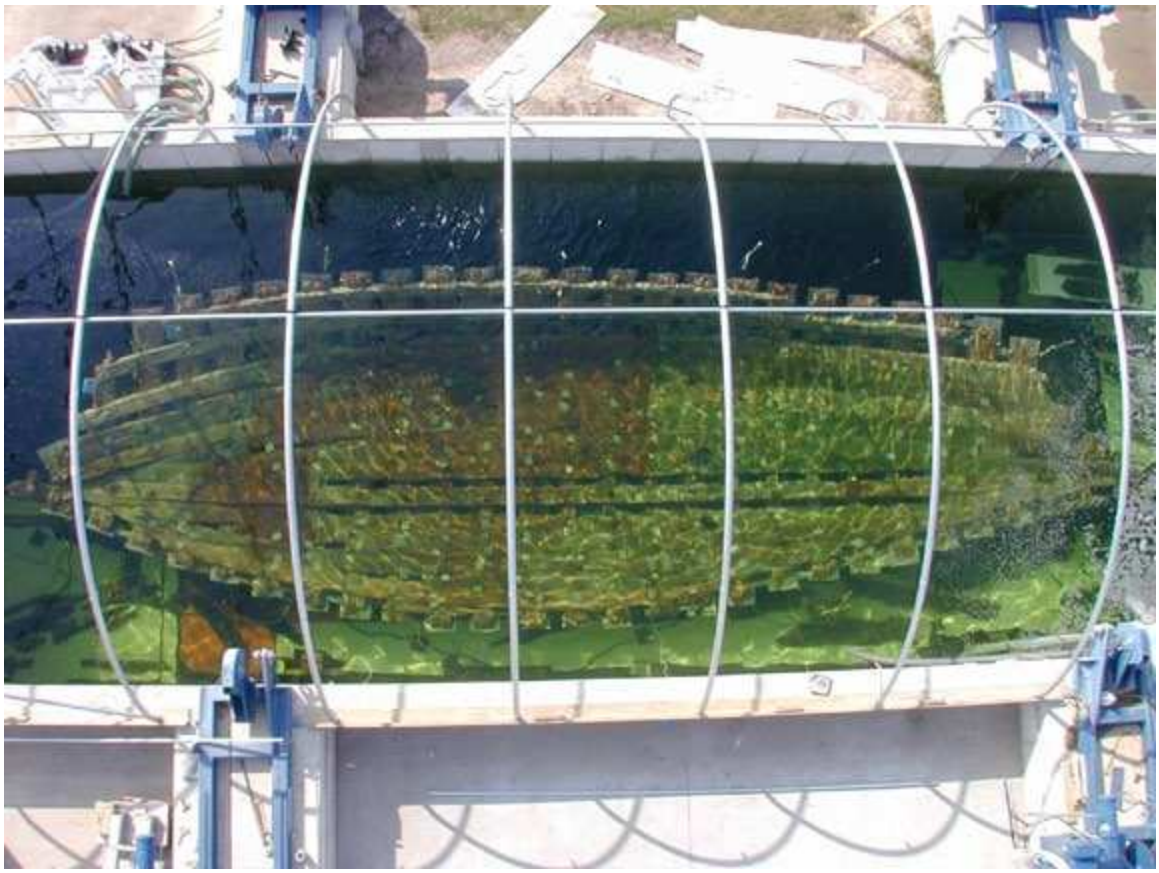
Taras Pevny and Peter Fix position a frame set back into sequence after creating a laminate. This process is required for each frame set. Note the weather is much colder, requiring the workers to wear wet suits and hats.

Taras Pevny secures the frame set back into position. Only 27 more to go!!!!

PHOTO GALLERY 14: FALL 2001

The reassembly of the hull of *La Belle* is virtually complete!

View of the reconstructed hull. Only a few minor timbers still need to be added.



Aerial view of the reconstructed hull.

Webcam Update: In order to protect the ship during the conservation phase, we have built a protective cover over the treatment pool. While necessary, this has unfortunately obscured the camera's view of the ship.

View of the newly built cover built over the treatment pool. The roof was constructed from a modified greenhouse kit.

PHOTO GALLERY 15: OCTOBER-DECEMBER 2001

We are almost ready to begin the treatment of the wood using polyethylene glycol (PEG). In order to protect the ship during the conservation phase, we have built a protective cover over the treatment pool.

October 29, 2001: Jim Jobling and his team have started to construct a customized protective roof over the vat.

The roof was constructed from a modified greenhouse kit.

Corrugated fiberglass panelling was used to
construct the ends of the structure.

The frame was covered with two layers of clear plastic that are inflated to provide an insulating barrier. A third layer of black pastic will be used to protect the ship from sunlight and to retain heat, as well as to retard algae growth.

View through the double doors of one of the eight vats that will be used to store the PEG

The roof structure will need to be removed in order to move the ship when treatment is completed.

Stage 5 - Conserving the Hull of *La Belle*.

Conservation underway. (Page last updated 2002)

Citation Information:

Donny L. Hamilton

1998, Conservation of the Hull of the *Belle*, Conservation Research Laboratory Research Report #7, World Wide Web, URL, http://nautarch.tamu.edu/CRL/Report7/hull.htm, Nautical Archaeology Program, Texas A&M University; La Salle Shipwreck Project, Texas
Historical Commission, Austin, Texas.

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