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Ticonderoga
The Side Paddle-Wheeler
(Part 1)

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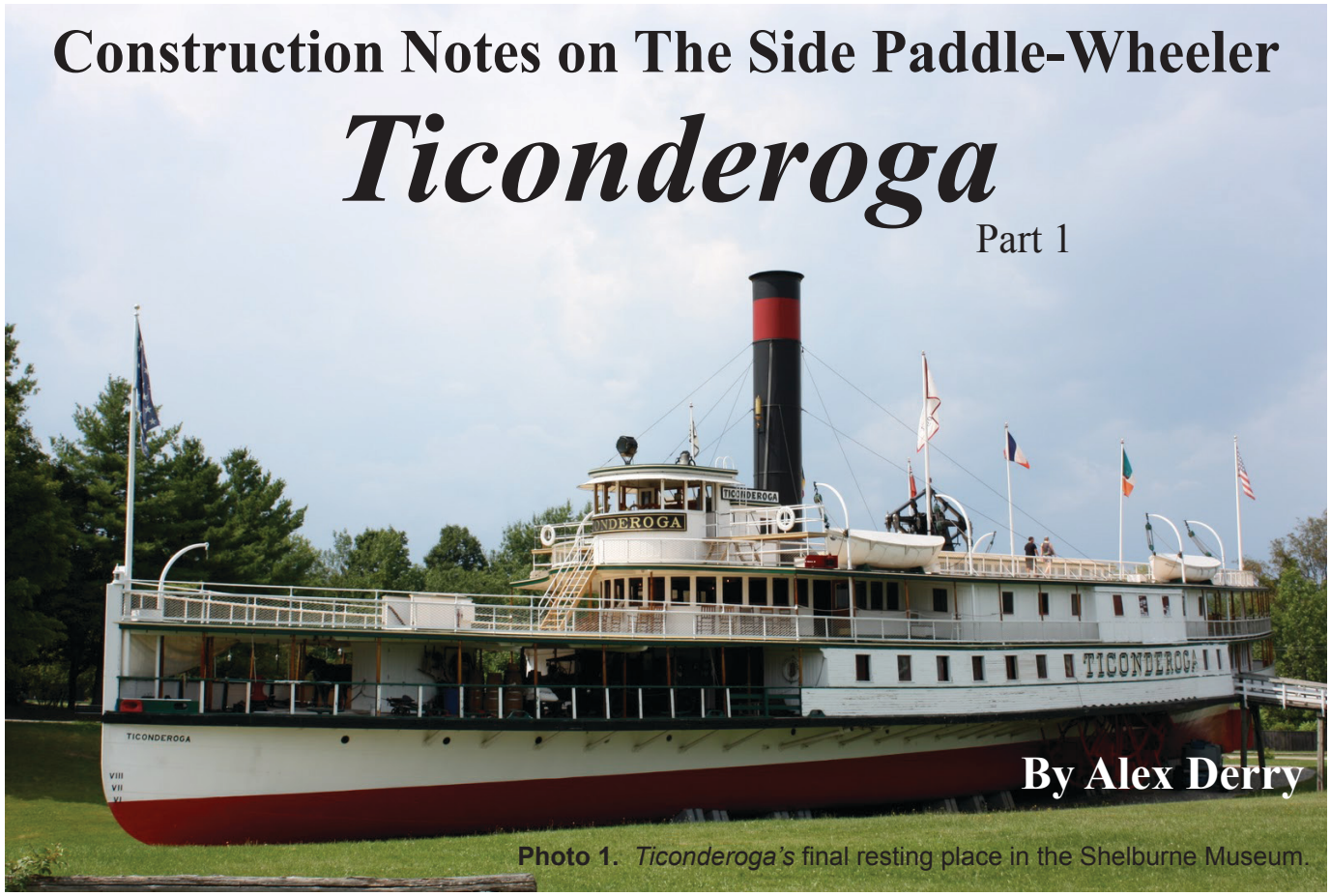
Construction Notes on The Side Paddle-Wheeler

Ticonderoga

Part 1



By Alex Derry

Photo 1. *Ticonderoga's* final resting place in the Shelburne Museum.

A brief history

Ticonderoga was built in the Shelburne shipyards in Shelburne Vermont; however, the Hoboken New York-based, W. & A. Fletcher Company won the bid to build *Ticonderoga*, and so the engine was manufactured in Hoboken New Jersey. The hull was subcontracted to the T. S. Marvel shipbuilding Co. of Newburg New York on the Hudson River. The hull was made in sections and shipped using the Champlain Canal to be assembled in the Shelburne shipyards. The engine also was shipped to Shelburne via the canal. *Ticonderoga* was launched on April 18, 1906, the same day as the great fire and earthquake in San Francisco. It took several more months to complete the assembly of the boilers, superstructure, and interior furnishings. Her first open water trial was held on July 22, 1906. Her hurricane deck had yet to be completed but by August 6, 1906, she began her regular service, a career which spanned most of the next half-century.

Ticonderoga supplied transportation for cargo and passengers. Notable was the ride given to Minnie the elephant on September 23, 1913. There were only two mishaps experienced. On August 17, 1919, she ran aground on Point au Fer Reef and a collision with a railroad bridge abutment after avoiding a collision with two fishing vessels. The accident near St Albans occurred on June 17, 1951. During her career, she had seven captains. The ships compliment averaged 29 members and had a career span of 43 years.

Photo 2. *Ticonderoga* crossing Lake Champlain.

Unique to *Ticonderoga* is her final journey. She was floated into a purposefully built dry-dock to begin her journey to the Shelburne Museum. *Ticonderoga* started her move on January 31, 1955. She traveled the two miles (3.2km.) over a sixty-five day period averaging 250' per day. The winter was the best season for this project since the frozen ground resisted deformity of the twin rail beds.

The 892-ton weight was cradled and supported by sixteen four-wheeled freight car trucks equally split between each of the two parallel rail beds. On March 10, an early thaw threatened to wash out the rail bed running through Wentworth Bicknell's dairy farm. Thankfully quick work prevented the possibility of Wentworth being the unintentional curator of a stuck *Ticonderoga*. Once located on the museum grounds, she went through an expert and intensive refurbishment and remains to be lovingly cared for by the curator Chip Stulin and chief engineer Peter Tomasi.

Steamer Ticonderoga Statistics

Year completed - 1906
In service - 1906 to 1932, 1936 to 1953
Type - Day boat for freight, passengers, and excursions
Builders - Champlain Transportation Company
Cost - $162,232.65
Length - 220'
Beam - 57.5'
Draft - 7'
Displacement – 892 tons
Capacity – 1070 passengers
Lifeboats – 4
Port of registry – Burlington Vermont
Decks – Turtle, Hurricane, Saloon, Main and Engine
Staterooms – 5
Hull – steel by T.S. Marvel Co.
Engine – reciprocating, vertical beam; W.&A. Fletcher Co.

- Number 193
- One cylinder: 9' stroke by 53" bore
- Weight of piston: 3 tons
- Steam pressure: 50 pounds per square inch
- Vacuum: 28"

Cruising speed – 17 miles per hour
Maximum speed – 23 miles per hour
Boilers – (2) Fire-tube, return flue: 750 horse power each: (hand fired); coal consumption (at full throttle) ; 2 tons per hour
Bunker capacity – 24 tons
Smokestack – outer shell 6' in diameter, inner flue 5' in diameter; height above the hurricane deck 38'
Paddlewheels – (2) Morgan-type (feathering)

- Dimensions: 25' in diameter
- Buckets: 10 each wheel
- Bucket dimensions: 33" wide, 9' long
- Paddlewheel revolutions: 28 per minute

My involvement started when I read an article in *Ships in Scale* by Seaways Publishing (Nov/Dec 2005) which, featured *Ticonderoga*. My immediate reaction was to pity the fool that attempted to build this elaborate complex vessel. Seven years later after completing a model of *Segwun*, I decided to look for a challenge for my next model. I wanted to broaden my construction methods to approximate

Photo 2. The lower foredeck cargo area shows the access to the details of the cargo present.

those used in the full sized vessels. Forgetting about my first impressions, I jumped into the research. Well, four years in the making this model has been a challenge!

Notable features of this model

The model is 1:48 scale. I have found that this scale allows for the possibility of enough detail while producing a reasonably sized model of five feet in length. This project is an outside and inside build which means that the model is a complete representation of the ship. The interior is accessible to the observer since there is sufficient lighting supplied by 120 LEDs and many of the windows are left open or partially open. Open windows allow for unencumbered viewing. Most of the windows on this ship could be opened so as to allow passengers to ventilate their quarters during the summer months on Lake Champlain. Window design varied from vertical pocket to horizontal pocket to sash types. As a result, I have made

Photo 3. The observer can peer into the two bunk-rooms found in the aft portion of the wheel house.

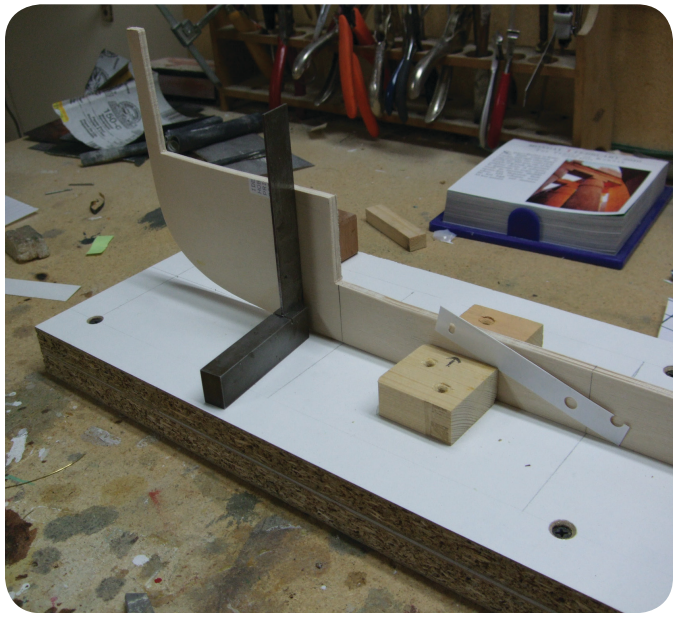


Photo 4. The keel mounted on the building board.

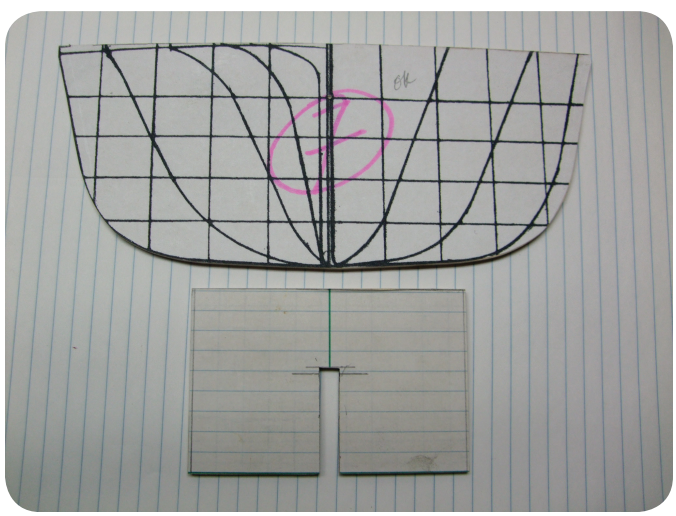


Photo 5. One of the body forms and the jig used to position the cut lines to fit the keel.

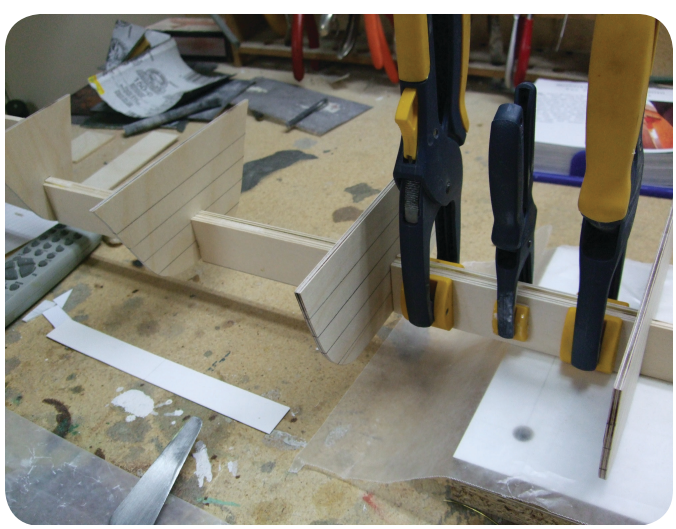


Photo 6. The reinforcement of the keel ensures the trueness of the keel and aids in the correct positioning of the body forms.

sure to provide the opportunity for the curious observer to peer into the interior by leaving open window and door vantage points as **Photos 2 & 3** demonstrate. I believe the element of discovery brings a unique quality to this model.

The construction of the hull

The hull shape for *Ticonderoga* is long and narrow much like a canoe. At 1/48th scale, the keel length is just short of 60". I decided to build the keel from two pieces of 1/8" model aircraft plywood laminated together under pressure while resting on the flat surface of the building board. Yellow carpenter's glue was chosen since it has a quick set but not so quick that adjustments can't be made. The glue grips the fibrous surfaces of the wood to ensure a solid weld. It is worth mentioning here that the building board on which

Photo 7. The apparatus used to align the body form to the keel on all three planes.

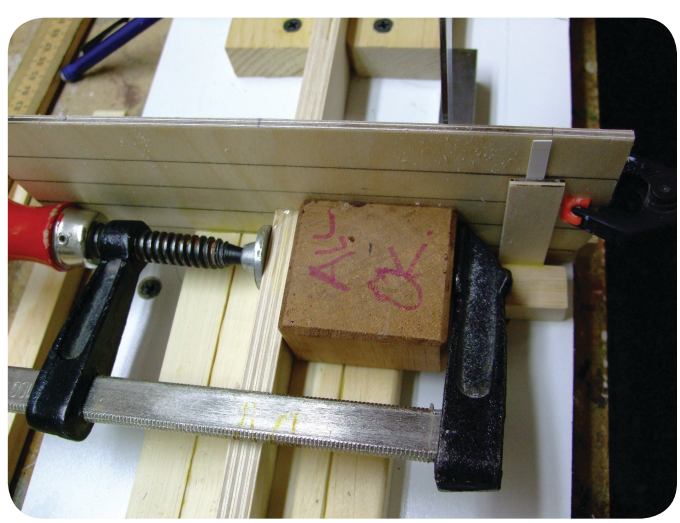


Photo 8. The decking is mounted in this space to accommodate the surface for the walking-beam steam engine.

the trueness of the whole hull depends, requires perfection. In this case, I laminated two one inch thick particle boards. Since these boards are manufactured using wood fibers and glue, which sets up free of warps. This is a generality, so one must be careful when selecting prospective materials. The only draw back of this type of board is the impact that a screw has on the surface during entry. I find that predrilling before hand, eliminates the dimpling of the surface and so ensures that squaring blocks lie flat to the surface as is needed. **Photo 4** shows the initial set up of the composite keel board. I have machined blocks of hardwood, which offers all around 90-degree angles. Each edge is beveled to avoid glue over run contact.

Photo 5 shows one of the body forms that give the shape of the hull at specific locations on the keel. All the shapes of the body plan are found in one drawing in the plans. Note that the lines for the body forms forward of the middle body form are found left of the mid-line while aft of the middle body form are on the right of the mid-line. When extracting the lines for each body form, a fresh copy of the general

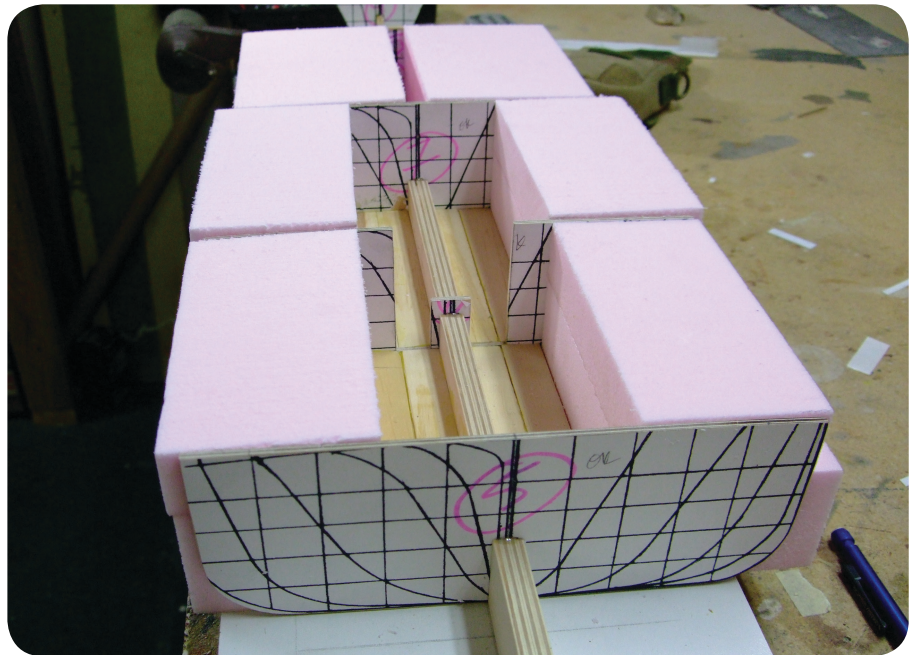


Photo 9. The foam blocks fill the spaces between the body forms leaving room for the engine.

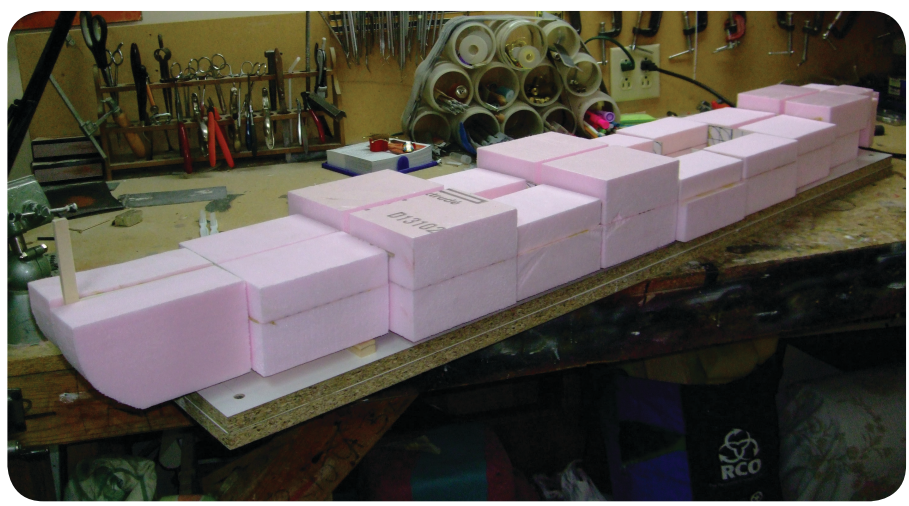


Photo 10. All of the blocks have been added.

drawing must be used. One might be tempted to fold the copy down the mid line and then cut out the two halves while using the one side of the drawn line. It is better to cut out the half body form for each and then transfer its shape to a pre-drawn midline. This avoids any distortion due to the movement of the folded halves during the cutting process. Each of these, require a slot to be cut to accommodate the keel. The jig shown below this body form was used to position the cut lines. The depth of each slot was determined by the height of the keel. Each cut needed to be perpendicular to the keel to help align the body form.

The precision of the location or station on the keel of each body form is critical. They also need to be correctly aligned about the keel and the horizontal. I decided to reinforce the keel by pairing 1/8" plywood on each of its sides. Care was needed to precisely cut each piece to ensure identical dimensions and that all was square. The length of each piece also needed to be the correct length to ensure that the position of the body form located on the keel correctly. **Photo 6** shows the process.

Photo 7 shows the required jigs to position the body form in all three planes. The block and clamp serves to align the body form on two planes – vertical and 90 degrees to the keel. Also, there is a "T" support resting against the body form which measures the height on each outside top edge about the keel, to ensure that they are equal. This is the third plane.

At mid-ships, there was a need to allow a space to accommodate the walking-beam steam engine. This encompassed two open sections including three body forms. The middle body form

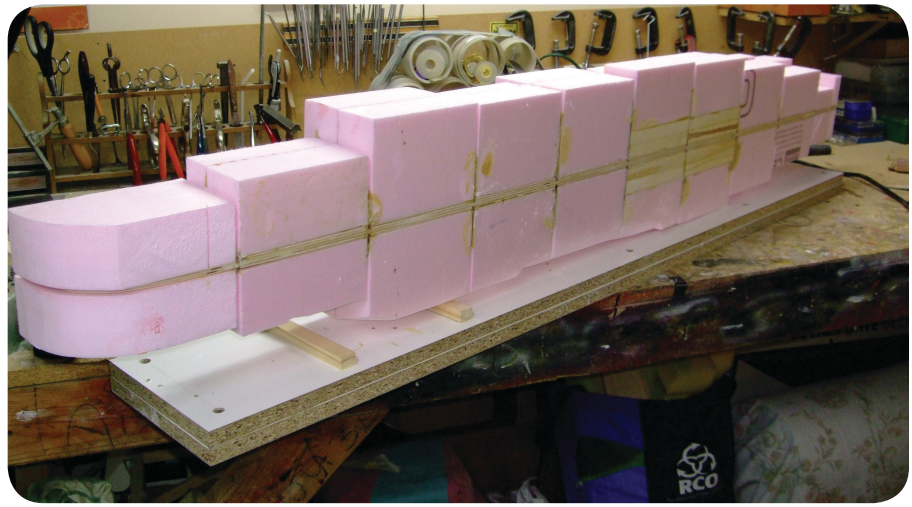


Photo 11. The blocks and wood filler fit flush with the bottom of the keel.

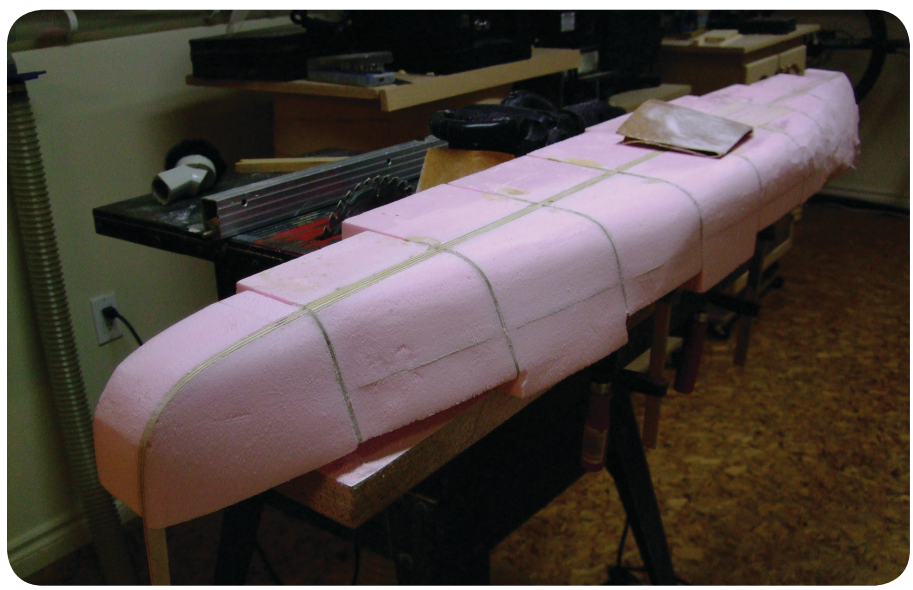


Photo 12. The first half of the sanding is finished.

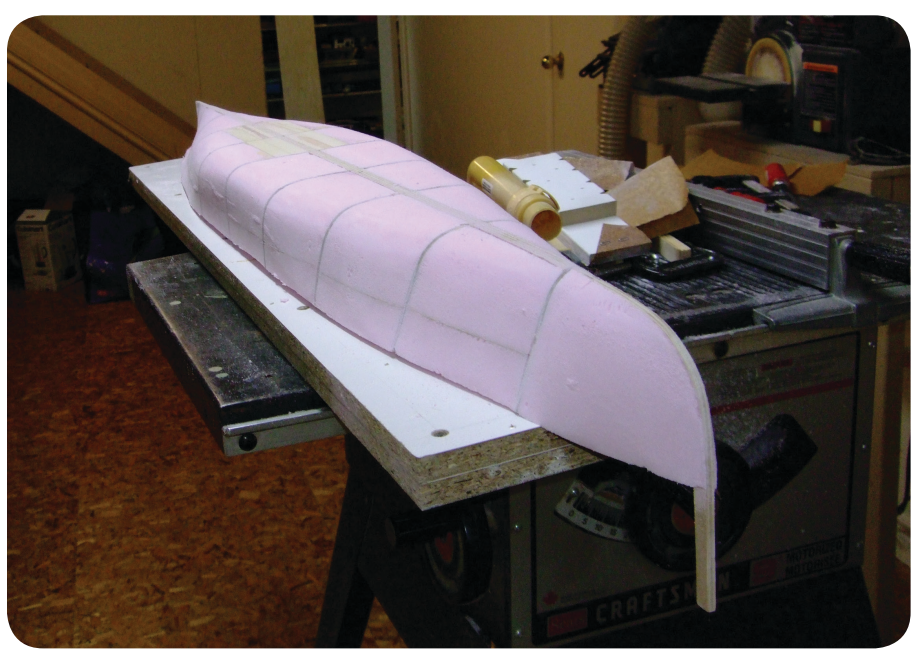


Photo 13. The hull has been finished.

Photo 14. The 1/16" plywood deck surface is being held to ensure that a thorough attachment is achieved.

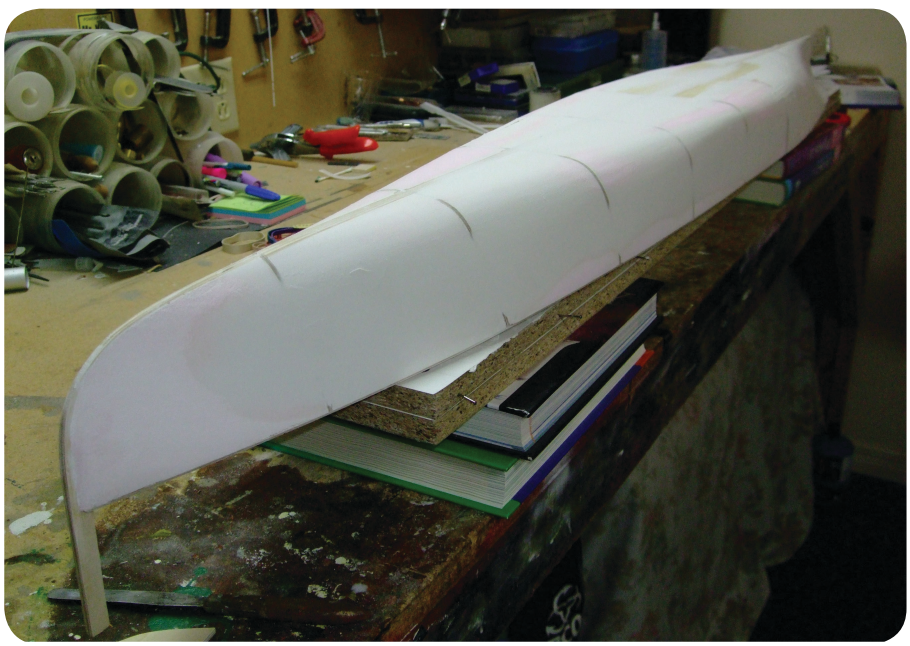


Photo 15. A talc-paint filler was used to refine the texture of the foam board.

Photo 16. The cloth easily drapes around the curvature of the bow.

also needed to be cut for the accommodation. **Photo 8** shows the decking in place for the engine mounts.

Once all the body forms were mounted to the keel, it was time to add high-density foam board to fill the spaces between each body form as is shown in **Photo 9**. The sizing of these pieces so that they fit perfectly between body forms is the challenge here. The foam provides more rigidity for the keel's trueness since the body forms remain positioned properly and now have an adhesive attachment to the foam board. The space for the engine is shown here. Specialized glue is needed here to ensure that it does not chemically react with the foam.

Photos 10 and 11 show the completed foam block fillers. The bottom of the wooden structure for the engine room is visible in **Photo 11**. The blocks and wooden fillers align flush with the bottom of the keel.

The next step was to file and sand the foam down using the body forms as a guide. This takes patience and an eye to ensuring that symmetry is obtained (**Photos 12 & 13**).

Part of the sanding process included bringing the foam board levels to that of the top of each body form. All the decks on *Ticonderoga* have a camber, so all the foam board was brought in line with the camber. Using the drawings, a 1/16"-plywood deck was cut out and then attached to the top surface of the hull. Included in this step were the openings for the forward stair set, another stair set found just forward of the mid-ships, another for the stair set in the dining salon and that for the steam engine. **Photo 14** shows the plywood deck being held in place while the adhesive sets. A combination of elasticized stiff but flexible

Photo 17. The ability of the cloth to drape around the stern shows its suitability for the job.

beams and some of my chemistry and physics texts added weight to ensure enough pressure was available during the cure of the adhesive. The flat bottom of the hull provided a stable resting surface during this step in the build.

At this stage, the edges of the plywood deck were carefully sanded to ensure a gradual curvature following the outer edges of the body forms. I found it necessary to fill in sections of the hull that I felt needed attention with a talcum powder- paint mix. This mixture sands very easily with out taking more foam board away. **Photo 15** shows some of that work.

When the hull was finished to my satisfaction, it was time to add the next layer. The hull needs protection since the surface is too vulnerable. A cloth and epoxy application works best. The epoxy is odorless and thin enough to penetrate the cloth easily yet, not thin enough to cause runs. The trick here is to find the best cloth type. Once again, the local Fabricland gave me a huge selection of material from which to choose. The material must be able to drape well enough to conform to the complex curves of the hull without the adhesion of the epoxy. **Photos 16 and 17** show the suppleness of the cloth at each end of the hull where it is paramount that these shapes be easily covered. I selected "Barcelona Knit – 94% polyester and 6% spandex" for the job.

The application of the epoxy onto the hull and into the cloth is a two-step process. The cure time for the epoxy was of sufficient length to allow me to attend to its application without time pressure. The first step of the application is to wet down the forward half of the hull. I used a small roller since it applies quickly and evenly a layer of resin. The hull is too large to attempt to wet it all down at once. As is seen in **Photo 18**, the cloth is pulled back to allow the wetting of the hull. Once wet, the cloth is draped over the area carefully to assure no wrinkles occur while the cloth is not stretched. The epoxy then was rolled on to the cloth surface with the result of its change in transparency. A consistent result in the transparency indicated the correct saturation of the cloth. The eager drape of the cloth ensured that a beautiful wrinkle free adhesion was accomplished with little effort.

The hull was left to cure and then was trimmed of its excess material. The next step is to mark on the hull the location of the frames and onto that the locations of the plates. We will proceed with these efforts in Part 2.

Photo 18. The hull is wetted with the epoxy before the cloth was placed onto the surface. Additional epoxy was rolled onto the cloth once smoothed over the wet hull.