

Building *Gondola*

History

Gondola is a steam-driven excursion launch running on Coniston Water in England's Lake District. She is owned and operated by Britain's National Trust, an organization which preserves and manages historical properties in England. Originally built in 1859 by the Furness Railway Company to enhance their tour operations, Gondola was retired from service in 1936. Her machinery was sold to power a saw mill and the hull was converted to a houseboat, eventually becoming derelict after a severe storm in 1963. In 1975 a group of local National Trust staff and members organized a salvage operation and after many trials and setbacks, mostly financial, arranged for the boat to be reconstructed by Vickers Shipbuilding in Barrow-In-Furness, on England's west coast about 20 miles south of Coniston. A new hull and machinery was necessary but some of the original frame and many fittings were reused. The restored boat was relaunched with appropriate ceremony (and in freezing weather) on March 25th, 1980.

A ride on *Gondola* is a not-to-be-missed experience. The boat is whisper quiet and seems to glide over rather than through the water at a respectable ten knots. Nearly 100 feet in length with a 16-ft beam, she accommodates 86 passengers in Victorian elegance. There are two cabins, First and Second Class, with room for 60; the remaining passengers are in open seating forward and aft. The First Class cabin is all red plush, gold leaf and mahogany with a quilted silk ceiling while Second Class is red leather and more utilitarian.

Plans and Machinery

The idea to build a model grew gradually after having ridden on the boat during a vacation in England. Although daunting as a first scratch-built project, since I'd wanted to build a steam-powered model for some time I decided to have a go. Of course, had I thought of it at the time I would have taken many more pictures! The first task was to locate plans. None were available through the usual sources and even the boat museum at Windermere had nothing (perhaps because their collection features only wooden craft). When first contacting the National Trust I was told that no plans for the boat were available either from the Trust or commercially, however, with assistance from an English friend lo and behold after about six months a single sheet of plans to 1/4" scale arrived. This was the plan used to install cabin heating and safety gear so was lacking sections and many details. Fortunately an article published in Old Glory, an English magazine devoted to restored engines and vehicles, had some good technical information and useful color photos.

Gondola is driven by a twin-cylinder "V" engine mounted under a coal-fired horizontal boiler similar to a traction engine boiler. Since a scale model of the prototype engine and boiler was far beyond the budget, I decided to adapt the Wileco D-49 marine engine which is a two-cylinder V, reversible and self-starting. This engine normally is supplied with a vertical boiler but the good folks at Diamond Enterprises agreed to substitute the horizontal boiler normally supplied with the D-48 engine. The boiler is fired by butane. This combination is slightly overscale for a 1/24-scale model, but I felt it would be an acceptable solution even though essentially designed as a toy. And with a few modifications such as paint to match the prototype, and cylinder lagging, it doesn't look half bad even though mounted aft of, rather than under, the boiler. The prototype uses the mass of the propeller as a flywheel but that wasn't possible with the model so accommodating the flywheel required moving the engine up in the hull and setting the prop shaft at an 8-degree angle.

The two-channel radio-control gear came directly from a model sailboat except that the functions of the servos were reversed; the sail servo operates the rudder and the rudder servo provides speed control and reversing. There was no room for conventional bell-cranks so the servos were mounted midship and connected to rudder and engine using poly (non-stretching) string running around pulleys and through nylon tubes along the gunwales. The receiver antenna is led to the midship's flagstaff which is formed around a 3/32" brass tube. When running, a 1/16" piano wire is inserted in the tube to give added height. Hobby Lobby's large brass rudder assembly was adapted by cutting down the mounting tube and replacing the rudder with one matching the prototype cut from 1/16" brass.

Hull Construction

Given the long narrow shape of the hull, plank-on-bulkhead seemed to be the most straightforward construction method and also parallels the original prototype, which was built using flush-riveted wrought-iron strakes on frames and bulkheads. The plans did not include sections so the first task (after getting the plans enlarged to 1/2" = 1ft) was to determine logical bulkhead locations and draw the bulkheads out on cross-hatched vellum. The bulkhead plans were glued directly to 1/4" aircraft-grade plywood and cut on the scroll saw. This was somewhat tricky because compound angle cuts were required to provide a smooth shear— it probably would have been easier to cut oversize and sand to shape. Machinery location, of course, dictated bulkhead positions in the aft section of the boat. Double bulkheads were used at the engine mount, and forward where there is a change in deck levels, and a triple bulkhead was located midship for strength. The prototype has a shallow almost V-section hull, but again, machinery room required a slightly deeper and rounder hull. An attempt to pre-determine stringer locations on the bulkheads was a failure. Keel and top rails can be marked, but stringers are best located after the bulkheads are mounted in the building jig. Solid blocks (built-up basswood) are used fore and aft, rabbeted to receive the planks and slotted for the keel and stem. The building jig

was made of parallel 1"x4" poplar stock with slots cut for the bulkheads; fore and aft blocks were mounted directly to the jig.

The keel was sawn out of 1/4" aircraft-grade plywood in three sections, glued with lap joints. A jig was made to drill the hole for the prop shaft, using a long 3/16" bit, and the prop shaft (3mm ID brass tube with a 3mm threaded rod to fit the prop) and prop installed at this stage. The propeller tube is provided with a vertical extension to serve as an oiler. The propeller is a 45mm 4-blade prop with about a 1.2 pitch which gives approximately scale speed at 300 rpm. Hull assembly started by screwing and gluing the keel and adjacent 1/4" stringers into the bulkheads. Top rails and stringers (1/4" sq. and 1/4"x3/8") were added next. The hull was planked using 1/8" basswood strips in conventional fashion, using masking tape marked with a No.3 pencil to determine plank taper. Planks were applied alternately at keel and rail, working toward the middle of each side of the hull. Not having a pair of proportional dividers, the planks were simply laid to measured marks on the bulkheads, which was less than satisfactory. Various plank widths were used, 3/4", 1/2" and 3/8"; doing it again I would use more of the narrower planks since it proved relatively easy to determine and cut plank taper. Since the planks curve significantly at the stern, and to a lesser extent at the bow, a plank steamer was jury-rigged from an electric wok, an (expendable) lid, some pipe fittings and a 1-lb coffee can. This was also used to bend the stringers. After planking (waterproof glue and 3/8" brass pins to hold), the hull was sanded and painted with several coats of spray enamel, rust-red below the water line, black above, and removed from the jig. Note that the screws which hold the bulkheads and blocks in the jig must be accessible from the top! The hull cradle was built next since from then on most of the work was done with the hull upright.

Machinery Installation

The engine was mounted to the bulkhead with rubber bushings riding on bolts, and a 1/8" rubber tube was used as a flexible coupling to the prop shaft. This is possible because the engine turns at low rpms so balance isn't critical. The boiler space was lined with thin aluminum sheet (it does get hot!) hopefully to provide some fire protection to the hull, and the boiler simply bolted to the hull stringers. The mount for the butane burner is also bolted to the stringers. The burner tip extends through a bulkhead to the boiler firing opening. The burner has to be removed for refilling of course and it's a very tight fit for the burner between the cabin wall and the bulkhead but fortunately with a little shaving here and there, the burner drops easily into its holder (this is what accounts for the arch over the rear cabin door - not quite scale).

The stack is mounted on the stackhouse which is an extension of the boiler-room casing. For the model the stackhouse was fashioned out of sheet brass; the stack is a length of 1/2" copper pipe. Twin (dummy) safety-valve vents of 1/8" pipe and the supply pipe to the whistle (3/32" pipe wrapped with thread to simulate insulation) parallel the stack. The whistle is

Bluejacket's no. 628. The engine exhausts up the stack but most of the steam condenses in the stack and drips into a reservoir. The stack assembly and stackhouse simply sits on top of the bulkheads and is removable along with the rear deck and stern seating so this reservoir can be emptied, which is necessary whenever the boiler is refilled, and to provide access to the rudder. The boiler casing itself, also made of brass sheet, together with the steering station mounted on top is also removable to allow access to the boiler for filling. The boiler casing, which features side doors which are opened when running to give added ventilation, does not rest on the boiler but is supported on the bulkhead forward and the stackhouse aft. The roof of the boiler casing forward has a sliding cover which on the prototype provides some protection to the firing aisle in inclement weather.

The 12-Degree Solution

Whether by accident or design, the angle of 12-degrees turns up in several places. This is the rake of the stack, the slope of the deck forward, and the inclination of the cabin and boiler-casing walls. Perhaps it is this uniformity that gives the boat its pleasing lines but it also complicates the modeling so it was necessary to cut templates by trial and error for the cabin walls.

After finding the right pattern, the walls were cut from 1/16" plywood, steam bent and glued to the cabin frame. The cabin roof is 1/2" balsa, sanded to shape. Balsa is really too soft for this application and probably should be glassed and gelled -- a future job. The cabin is designed to be mostly watertight to provide some flotation should the unthinkable happen. Since the cabin roof is removable to access the radio gear, a tight fit is required between the roof and cabin frame. Slide clips used for mounting airplane wings were adapted to hold the cabin roof in place. Doors were cut from 1/16" plywood, carved to simulate panelling, with brads and bits of brass wire to replicate hardware.

Counter and Decking

The raised counter around the rear deck also required trial-and-error cutting of a poster-board template to generate the compound angles, and was cut from sheet brass and secured to the top rails with screws through tabs left on the pattern. The rake of the counter aft is 40 degrees. The lip of the counter was reinforced with flattened brass wire, which also provides added support for the wood railing which tops the counter.

Decking is plywood and basswood strip covered with deck sheets with 1/8"-wide basswood planking. These deck sheets are available from several sources -- mine came from Micro-Mark. Individually-laid planks would have been more realistic, of course, but the deck sheets provide an acceptable substitute which no doubt looks better than had I attempted laying

individual planks. Floors and decks that take foot traffic were stained walnut, and the remainder was stained cherry which is a fair simulation of the teak on the original. Before laying the decks, lead strips cast from old tire weights were laid between the hull stringers to add ballast as required to trim the boat; about 1 1/2 pounds located more or less uniformly fore and aft.

Seats and benches were made from 1/8" scribed basswood siding as used for dollhouses etc. (again from Micro-Mark). A hard pencil was run in the scribed grooves to simulate open slats and the wood was stained cherry and sealed. Life vests were carved from balsa and stowed under the benches forward.

Railings and Fittings

The steering station was fabricated from 1/8" brass angle and 1/16" rod and is pretty straightforward. The engine-reversing lever extends up from the boiler casing as does the throttle valve rod. The throttle valve handle was carved out of sheet brass, although I'm sure there's a suitable fitting out there someplace. Decking is 1/8 x 3/32 strips notched to form a gridwork. The wheel and pedestal is boxwood with brass-painted trim, a stock item from Model Shipways, available from Model Expo or other sources. A shelf of 1/16" plywood tops the pedestal. Life rings are also from Bluejacket, as is the ship's bell, with lettering printed on the computer and glued on with CA since I couldn't find any 9-point press-on lettering. A piece of very fine silk was commandeered to simulate the canvas siding which wraps the steering station, held on with thread which wraps through holes in the top frame and loops around the lower piping. The railing is 3/32 x 1/4" basswood.

Stanchions are 3/32" brass pipe with cotter pins inserted to provide a top fitting for the 3/32" top rail. The middle railing is 1/16" rod run through the stanchions. The prototype has a netting covering the railing to keep passengers inboard but so far I haven't been able to find a suitable scale substitute. Railings forward and along the boiler casing roof are constructed similarly. Cleats and chocks are painted white metal, again from Bluejacket. The mooring bitts are fabricated from brass to match the originals, although suitable castings are available commercially.

Flagstaffs fore and aft were shaped from bamboo chopsticks from a sushi bar. The straight grain of bamboo provides needed strength for this application. Finials are decorative gold-plated beads; rope leads are simple rings and brass cleats set into the staffs.. Fore and aft flags were obtained from Model Dockyard in the U.K. (www.dockyard.com.uk), manufactured by a firm called Hand Made Flags, although less-expensive versions are available from Model Expo. The midship's flag is the National Trust banner, an emerald-green field with the words "The National Trust" and a white cluster of oak leaves in the upper left quadrant. This was computer-printed on varnished silk following a full-scale design which was kindly furnished by

Gondola staff of the National Trust. The flags were secured to the flagstaffs with the same Amati 0.5mm rigging line used elsewhere to simulate rope.

The prototype has elaborate carvings on the bow. There is a coiled snake figurehead which looms over a "Cap of Authority" on the stem. These were modeled from a plastic modelling material, but not very successfully. Still to be attempted are the bow decorations themselves consisting of a black shield with gold trim and stags pulling a sleigh, all gilt and colored.

The prototype has elaborate carvings on the bow. There is a gold-colored coiled snake figurehead which looms over a red and gold "Cap of Authority" on the stem, and on the bow, a black shield with the National Trust oak leaf cluster in white with gold trim and stags pulling a sleigh over the waves, all gilt and colored. The snake was carved out of basswood and the remaining figures formed out of "DAS pronto," a plastic modelling material available in art supply stores. The material was rolled into a thin sheet, cut roughly to size and applied to the bow and allowed to dry, then epoxied, carved to shape and painted. This turned out to be one of the more challenging and time-consuming chores since I am not much of an artist.

Finishing

Paint colors used are exclusively Floquil's railroad colors, including metallics -- bronze, copper and gold -- and stains. "Reefer Yellow" was used in the cabin cutouts and the boiler casing and metalwork is Roof Brown. Cabin sides and roof and rails and stanchions were sprayed with Krylon satin white. Rub rails and trim are Signal Red.

The ship's dinghy is "Laughing Whale's Pram." Although not true to the present ship (which has some rather ugly brown flotation rafts), this addition could be consistent with the 19th century version of the boat.

The prototype boat is not equipped for night running so carries no fixed lamps but these may be added. The engine itself provides realistic engine sounds but a whistle would be nice and is a future project, and the cabin interiors still are to be finished at present having only a rug patterned after the original (painted plywood) and some trim in the first class section.

Under steam the model handles well and is responsive to the helm. One burner fill gives about 15 minutes of running. The reversing valve and throttle sometimes has to be toggled to coax the engine to start, but once underway speed control is smooth and reversing provides good maneuvering so the boat is fun to drive and gets many admiring looks. All in all it was a worthwhile and rewarding project, even though when I started I didn't expect to be devoting almost two years of on-and-off spare time to it. Since I have all these newly gained skills I'm

looking for my next project; Freedom Song's “Arnold S.” looks like a likely candidate, although I'd hope to drive her with steam!