

The Cruiser Class Brig - Instructions for Assembly

1 Complete the Hull and Deck Assembly

a. Finishing up the hull:

Clean the hull seam using sandpaper. End up with 400 grit. The bottom of the keel needs to be even but not perfect.

Sort out the three servo blocks according to plans A & B. Measure, mark and drill the holes (1/4", 6.35mm) and emplace the servo bolt inserts (flush).

~The servo deck is already bonded into the hull with the keel rod tubes.

Slide the ABS mast step blocks over the keel rod tubes and bond to the servo deck with 60 minute epoxy. The longer block is the forward one. The mast step blocks with their holes are glued into these blocks when the masts are stepped. Check the fit and glue the servo blocks between the mast step blocks.

Mark the outside of the hull at the stern tuck with a pencil (approximately 9/32", 7mm Ø) lying flush and upright against the sternpost. Drill a small hole keeping it as parallel to the sternpost as you may. Now from the inside of the hull enlarge this hole (maximum 1/2", 12mm Ø) so that you can see the sternpost, but try not to cut forward of it. This is to allow you to position the stern tube correctly - inside forward wall flush and parallel with the sternpost. The top of the stern tube needs to be a little shy of the underside of the deck, since if there are gaps after you have bonded the deck in, you can still fill them from the outside.

Cut out the stern tube template from the plan attached. Wrap it around the stern tube stock, using the two vertical lines as start and finish points, and cut and sand until the stock matches the template. Temporarily put the bulwarks in place but see "b. Fit the deck iii)" below *before* fitting. Put the trimmed stern tube in the correct place in relation to the sternpost and, using a spline between the undersides of the bulwarks, make sure its top lies a deck thickness under this spline. Sand if required. Glue in place with a sufficiency of epoxy resin mixed with chopped fiber. Cut out the hull inside the tube.

b. Fit the deck:

~Be careful not to mar the wood surface of the deck. We recommend masking it off. All of the joints in this section need to be filled with resin or isocyanacrylate (in the case of the keel rod tubes) because they need to be *completely* watertight. *Plenty* of resin and then cutting off the excess or peeling off the tape is the way to do this.

i) Cut a notch in the front edge of the ABS mechanical hatch well to give clearance for the forward top keel rod tube. Do not break through to the inside of the well. Glue in the hatch well with

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isocyanacrylate. Make sure that this is a good bond and lines up with the fiberglass deck. If you can pull it off it was not a good enough bond. Support the mechanical hatch back seal in the well with equal height spacers so that it rests just proud of the surrounding wall. Glue the mechanical hatch to the back seal with isocyanacrylate.

~In use this hatch may be made quite watertight by smearing a little vaseline on the back seal where it rubs against the wall of the hatch well.

ii) If you want to pin your deck fittings to the deck, drill 1/16" (1.6mm) holes for the brass rod supplied.

~It is advisable to make a little jig with the two holes correctly spaced so that they are all the same (in the case of the cannon) and so that the fittings can be drilled using the same jig.

Drill the holes for the polypropylene tubing fairleads, 9/64" (3.5mm). If you need to, use the plan A by cutting it out to the edge of the deck, lining up the planking, taping it down and drilling through it. Drill two 1/4" (6.35mm) holes as shown on plan A for the keel rods.

The location for the two holes for the lower masts is shown on plan A. Mark them on your deck and drill holes (1/2", 13mm) in the centers. Rather than using a regular drill bit, use one with a 90° included point angle or a sharp countersinking bit so that you do not fracture the fiberglass underdeck. Enlarge each hole to the required diameter using a file or drill with a grinding tool.

~When you step the masts they are sealed to the deck with silicone seal.

iii) ~The height of the deck is determined by the 2 bulwark pieces with gunport cut outs which fit under the rail.

Put the telescoping fiberglass keel rod extension tubes (inside taper *down*) into the keel rod tubes so that when the deck is glued you can slide them up against the underside of the deck and bond them to it. Force the deck into the hull - it can be quite a tight fit. If you cannot get it in you may trim the hull flange (fiberglass return that forms the mainrail) back to 5/8", 16mm overall with a router. Fit and glue in the bulwark with hot melt glue or equivalent *temporary* cement using the sections as a height guide. Their aft end butts against the transom. The fore end where they meet is either cut away by the bowsprit hole or hidden under the bowsprit and so is not critical. Bulwarks should be warmed to become *just* pliable by leaving in the Sun, with a hairdryer (dangerous) or in hot water. **Try this on scrap first!** Coarsely sand the bulwarks so they can lay fairly flush against the hull material (see sections) and clamp so they stay so.

The bottom edge of the bulwark should contact the deck, so lift the deck up and support it with bendable sticks wedged to the internal keel space or folded foam rubber, tight against the bulwark. When satisfied glue in scrap blocks of wood, or even use car body filler (but don't let it bond to the unglued deck), to form steps for the deck to rest on. 8 per side is plenty.

iv) Remove the bulwarks and deck. First ensure the masts are correctly raked (see plan D) and

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straight when viewed from the bow or stern. Glue in the deck with epoxy resin mixed into a paste with a filler (chopped fiber or glass beads) from the underside. Be sure to fill the entire deck-to-hull joint up to the level of the deck at least. Bond the keel rod extension tubes and stern tube to the underside of the deck.

Use a piece of dowel to line up the keel rod tube extension as you glue it. Remember to glue the middle joint on these tubes. Glue the bulwark in place, trimming off any resin that gets in the gunports, and again masking the inner surface. Check the seam at the underside of deck to stern tube, fill if required.

c. Trim the rail:

The rail is molded into the hull. Trim the top edge of the fiberglass with a laminate trimmer or rasp/file so as to make it smooth and flush with the bulwarks (see sections).

d. Painting Information:

Painting can be done when you chose. This section is here just because it has to be somewhere. Color chips are provided. There are five elements to the way we paint these ships which we perform in the following order:

- i) painting the hull black: This is to cover up any scratches made whilst sanding the hull seam, gluing on the stemhead, etc.*
- ii) paint the yellow ochre stripe.*
- iii) paint the bulwarks and insides of the gunports red ochre.*
- iv) paint below the waterline, dirty, verdigris copper.*
- v) optional: paint the transom (and ship's boat) blue.*

e. Attach the stemhead, cut the gammoning slot, gunports, hawseholes and scuppers:

- i) Drill a large (1/2", 13mm) hole in the center of each gunport (measure carefully!). Router (using the bulwark cutouts as a guide) the gunports.

~Edge-trimming router bits have a ball bearing on the end of a straight cutter of the same diameter. This bearing follows the bulwark gunport wall and allows the cutter to cut the hull to exactly the same shape.

If there is resin on the inside walls of the ports, remove it. Square the corners with a file. Fore and aft chase ports are not cut. They can be marked on the bulwarks or hull with permanent ink if you so desire.

- ii) Mark the gammoning slot on the stem. Drill athwartships at either end of this slot. Use a jeweler's saw and file to complete.

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- iii) Drill the hawseholes, 2 each side, horizontally, as indicated on the plans A and B.
- iv) The stemhead is provided. Drill a 1/4" (6.35mm) hole in its base and glue in a pin made from a piece of wood dowel. Drill a larger hole than this pin in approximately the right location in the stem and make sure the stemhead can line up. Now glue on with epoxy, filling the oversize hole. Sand and fill to make a smooth match.
- v) Glue on, using isocyanacrylate, the 3/16" x 3/16" (4.8 x 4.8mm) pieces of triangular strip wood to form the waterway from stem to stern.

Drill the scuppers midway in between each gunport *except* the first and last places so defined (therefore a total of seven each side). Drill from the waterway at 20° downwards from the deck plane at that point with a 1/4" (6.35mm) drill, at right angles to the run of the bulwark. These holes are to allow water to run off the deck.

~It is easy to make yourself a jig to guide your drill: see plan B. The exit holes of the scuppers do not line up with any feature on the outside of the hull, but they should form a smooth curve.

Cut lengths of the 1/4" (6.35mm) o.d. fiberglass tubing with 20° ends and glue them in these holes with the angled end inboard and flush with the bulwark. Fill (polyester filler) any chips made by the drill on the outside of the hull and sand the tubes flush on the outside.

f. Attach the bowsprit rest:

Cut a notch in the top of the rest to allow the cable tie that holds the mainstay to be threaded around the bowsprit (see Plan A). Sand the front surface to roughly fit against the stem and bulwarks when the aft end is the correct distance from the mast. Paint red ochre. Glue to the deck and stem with epoxy, right on the centerline.

g. Attach the rudder, servo tray and adaptor:

- i) Screw the rudder base plate to the inserts in the bottom of the keel with the ss 10-24 screws.
- ii) Mark a spot with a standard pencil (about 9/32" (7mm) diameter) keeping the pencil against the sternpost, at the forward upper end of the rudder passage through the hull (stern tube). Drill a 1/16" (1.6mm) hole from the bottom. You will not be able to drill parallel to the sternpost. From the top enlarge this hole to fit around the rudder axle. Once you have it fitting cut the shaft down and open up the deck to allow the rudder shaft adaptor to fit into the deck as shown in the plan.
- iii) Assemble the rudder servo to the tray (the plate over it and the two bolts through) and attach the servo horn. Trim the excess horn arms. Test fit to the rudder adaptor. The back of the tray will need to be sanded (or shimmed) to allow it to fit. Test the raised deck (see 'h' below) to make sure you have enough clearance. The alignment is important. Cross drill and pin the rudder shaft adapter

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in place. Leave the pin long on the fore side to allow it be removed as required. Glue the tray to the stern with epoxy. Drill a hole in the fore part of the stern tube and thread the servo cable *with extension connected* through it. Silicone seal this hole. Clean an area of the under surface of the deck where this extension connector is and glue the connector up to keep it away from water in the bilge.

~Avoid turning any of these powerfully geared servos by hand - always use the transmitter and receiver, otherwise you can damage them.

h. Add the raised decks, ladders and knightheads:

i) Laminate the 2 pieces of screened wooden deck to the top of the two fiberglass raised decks with contact cement (see plan A). Check the fit of the decks inside the bulwarks - their top surfaces should be an even 1/16" (1.6mm) below the top of the rail. Cut the slots in the raised foredeck for the strap (large cable tie) that goes around the bowsprit and holds the removable lanyard (another large cable tie) that attaches the mainstay; see plan A. Drill the hole (9/64", 3.5mm) for the driver sheet polypro fairlead in the main deck before gluing the aft raised deck. Sand as required and glue in with 5-minute epoxy. Reinforce this joint underneath with pieces of 1/8" x 1/4" (3.2 x 6.35mm) strip wood. Add a 1/4" x 1/4" (6.35 x 6.35mm) beam under the aft end of the fore raised deck, running from bulwark to bulwark, same for the aft deck. Make the foresail hook (1/8" (3.2mm) brass rod) and glue into a drilled hole in the center of the aft side of the fore raised deck beam.

ii) Make the timber- (small) and knightheads (large) from the 1/4" x 1/4" (6.3 x 6.3mm) and 3/8" x 3/8" (9.5 x 9.5mm) wood strip provided, respectively. Drill holes in the bottoms for pins cut from 1/8" (3.2mm) dowel. To angle the tops, cut a shallow kerf around the square with a fine-bladed backsaw at the correct height. Using a small sharp chisel blade, cut away the wood at an angle, from nothing at the very top to an eighth of the width of the square at the kerf. Try this on a piece of scrap first - it is easy.

iii) Drill holes in the rail for the knight- and timberheads (position as shown on plan A) and glue them on, making sure one edge of the square timber is parallel with the rail. Drill and glue in the 2 bowsprit shroud eyes and the bobstay eye as shown on plan B.

iv) Glue the steps into the the pre-slotted sides to make the 2 ladders. Sand or cut to fit to the raised decks as shown on plan B. Glue in place with isocyanacrylate as per plan A.

i. Make the hole for the bowsprit:

Drill an initial central hole of 1/4" (7mm). Pay attention to the actual angle and location of this hole, in relation to the rail, as shown on plan B. Enlarge it with a second drill to allow your round rasp to fit. File the bottom edge of this hole down until you are at the bowsprit rest. Now enlarge the hole slowly until it fits the bowsprit and is tangent to the rest. Square down the edge of the elliptical

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cut in the raised deck so that it is even and will not splinter.

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j. Test for watertightness

Now is the time to test. It will help if you attach the ballast keel (to give stability and correct level of flotation). A little flashlight and a small mirror will help you check for leaks in the belowdeck space. Tilt the hull, press it down until water approaches the mechanical hatch.

k. Attach the inner rail trim and head rails:

- i) The inner rail trim is made up from lengths of the birch strip 1/16" x 3/8" (1.6 x 9.5mm). Checking the fit first and starting at the raised foredeck, glue lengths on the inside of the bulwark, using isocyanacrylate and clothes pins, flush with the top of the rail, butting the second against the first until you reach the stern. Cut and glue a piece against the transom. Round the top edge to equal the radius of the outer top edge of the rail and fill the seam if you so desire. Paint black when you paint the hull.
- ii) The head rails are glued in position with isocyanacrylate, per the plan. Clean up the castings and assure that the aft ends fit snugly against the hull.

l. Paint the hull:

- i) Paint the hull black, masking off those areas (deck) that don't get any paint. Mark the hull all the way around with the waterline. The height of this line is indicated on plan B. Prop the hull up securely on a good flat table so that these marks are both at the *same height* from the surface. Ensure that the rail height is the same both port and starboard at any particular gunport. Now, taking a block of scrap wood or anything that has a flat top that you can rest a pencil on it, adjust its height and then slide it around the hull marking the waterline with the pencil. Mask off above this line and paint the below-water portion of the hull a verdigris copper. Now mask off the portion bounding the stripe. This can be done using 1 1/2" (40mm) masking tape (or two pieces of 3/4", 20mm) put all along each side, from the stem to the transom, set parallel to the rail and 1/8" (3.2mm) below it, representing the stripe. Mask off the area adjoining it, then remove the 1 1/2" (40mm) masking tape to expose the stripe area which can then be painted a yellow ochre.
- ii) Mask off the outside of the hull so that you *seal* the gunports on the outside. Mask the deck and the rail above the bulwark. Paint the bulwarks, including the inside of the gunports red ochre. The areas under the raised decks should be painted with a brush.

m. Attach the channels:

Mark the beginning point of each channel on the rail, using the dimension from the edge of the relevant gunport, as shown on plan B. Check that the channels fit smoothly against the outside of the ship, just below the rail. Sand to fit if required. Paint them black, except the gluing surface.

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Clamp the channels in place as a final check, then glue them on using 5-minute epoxy.

n. Side Steps:

Check the fit of these; you may need to change the back angle slightly on a few to keep their top surfaces parallel to the waterline. Seal and glue on with isocyanacrylate.

o. Catheads:

Check that the catheads fit smoothly against the outside of the ship, see plan. Sand to fit if required. Paint them black, except the gluing surface.

2. Assemble deck fittings and chains:

a. Cannons & Carronades:

Assemble cannon carriages from the laser cut 5/32" (4mm) marine ply parts. These parts are meant to fit loosely together. Glue with wood glue. Position the rear wedge so it supports the barrel. If you want to pin the cannon to the deck, drill holes through the two cross pieces. Use a jig for consistency. Pins should be made from 1/16" (1.6mm) brass rod. Paint dirty dark brown. Glue on wheels. Paint cannon barrels black and glue on. Glue to deck using isocyanacrylate on wheels or pins. See plan A and attached diagram.

Assemble carronade slides, carriages and barrels from the CNC cut wood, plywood and machine screws (see diagram). The chocks need their inside top edges sanded off to fit to the barrels. Paint or stain.

b. Three deck hatches.

i) The fore hatch is assembled from the 1/4" (6.35mm) wood pieces: 2 sides and 4 cross pieces, the birch strip wood 1/8" x 1/8" (3.2 x 3.2mm), the hatch grating and the backing plate (plan A). Cut three pieces of the grating to the size shown. Paint the top a wood brown. On a flat surface, glue, using wood glue, two cross pieces inside, and at the end of, the side pieces using the plan as a positioning guide. The tops should be flush. Sand the top outer edge of the side pieces until the curve of the cross pieces is continued outward across them, all the way along. Cut 2 lengths of 1/8' x 1/8" (3.2 x 3.2mm) strip wood to the same length as the side pieces and glue them to the top, flush with the outside edges. Cut more strip wood to bend across the four cross pieces, in between the side strips, and clamp and glue on, flush with the outside or centered, respectively. Lay these in and check the evenly spaced fit of all three gratings. Paint the assembly black. Cut (with a knife or scissors) and glue the backing plates in so as to make the deck invisible when you look through the top. Glue the gratings in with isocyanacrylate. Cut away the port and starboard corners of the foremost grating as shown on plan A to allow the anchor cable to terminate within. If you want to pin the hatches to the

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deck, drill 2 1/16" (1.6mm) holes, centered at each end (use a jig), otherwise just glue to the deck in the position shown.

ii) The main hatch is similar to the fore hatch.

iii) The companionway/light is assembled from the 1/4" (6.35mm) wood pieces: 2 sides, 2 walls and 5 cross pieces, the birch strip wood 1/8" x 1/8" (3.2 x 3.2mm), the 5/32" (4mm) marine ply companionway roof and the black plastic light rails. On a flat surface, glue, using wood glue, two of the cross pieces at the end of the side pieces. Make sure you get the port (lower) and starboard side pieces the right way around. The tops should be flush at the ends. Glue the two companionway walls to line up with the ends of the vertical edges in the middle of the side pieces. These should all be flush on top. Glue the roof piece on, overlapping the edges equally; round the edges. Glue two cross pieces against the companionway cross walls, and the last cross piece exactly halfway between the aft two cross pieces. Sand the top outer edge of the side pieces until the curve of the end cross pieces is continued outward across them, all the way along the lower surface. Cut lengths of 1/8" x 1/8" (3.2 x 3.2mm) strip wood and attach it as for the other hatches. Paint the assembly black. Cut the light railings to size and glue in with isocyanacrylate; cut and glue in the backing plates. If you want to pin the hatch to the deck, drill 2 1/16" (1.6mm) holes, centered at each end (use a jig), otherwise just glue to the deck in the position shown.

c. The wheel.

The wheel base is made up of three pieces of 1/8" x 3/8" (3.2 x 9.5mm) beech, cut to length and angled as shown on plan A and B, drilled and glued together with wood glue. Drill the two uprights for the 1/8" (3.2mm) wheel axle and the base for a pin if you intend to pin it to the deck. The wheel drum is cut from 2 sizes of birch dowel and drilled for the 1/8" (3.2mm) brass rod wheel axle. Drum and frame can be sealed, stained and sealed, or painted black. The pre-cut black ABS wheel and the drum you just made are placed between the uprights and the axle pushed through. It should be cut flush fore and aft and held in place with a drop of isocyanacrylate. Attach to the deck as above.

d. The bitts.

i) The bowsprit bitts: cut the 2 uprights to length (see plan B) from 5/16" x 5/16" (7.9 x 7.9mm) birch. Cut the cross piece to length and chisel out 2 1/32" (0.8mm) deep mortises to accept the uprights. Angle the tops of the uprights as you did the knightheads. Assemble the backstop, the aft receiving plate and the fore receiving plate (5/32" (4mm) marine plywood) to the uprights and cross piece. Glue with wood glue. Glue on the support knees (1/4" (6.35mm) wood). Drill for pins if you are to use them (strongly recommended for this particular piece) and glue to the deck.

ii) The anchor bitts: as above, but using 3/8" x 3/8" (9.5 x 9.5mm) birch, rounding the aft

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athwartships' edges of the cross piece and without the backstop or receiving plates. Check for squareness before gluing.

iii) The two gallows bitts: cut the two uprights for each of 5/16" x 5/16" (7.9 x 7.9mm) birch and the cross pieces of 3/8" x 3/8" (9.5 x 9.5mm) to length and glue together. Check for squareness.

iv) The mainmast jeer bitts: as with the anchor bitts above, but no angling at the top of the uprights.

e. The ship's boat (24' launch)

This is kept on chocks on the gallow bitts secured by manila line. It can be painted blue, with a 1/4" (6.35mm) black or white trim around the gunwale. Add the styrene strip .04" x 5/32" (1 x 4mm) around the outside of the gunwale and below the thwarts. A stem piece (from scrap) rising slightly above the formed hull adds realism. The interiors of the boats are detailed with the pre-cut wood components, the gratings and the printed flooring, stained, painted white or wood color as appropriate. Glue the rudders (paint black) to the sterns or leave unshipped. The assembled gratings need to have their undersides sanded to fit the shape of the hulls. Stain and glue the chocks in place on the beams of the bitts and lash the boats down with manila running rigging line.

f. The anchors

The two large anchors consist of cast stocks and shanks/arms and a metal ring, to which is seized the heaviest cable. The two smaller anchors are similar but use 1/8" (3.2mm) brass rod for the stock. For these put a 60° sharp bend in the brass rod and cut to 4" (102mm) on one side of the bend and 3/8" (9.5mm) on the other. Paint black and glue, centered, into the shank with the short bend facing down. Drill the shanks to fit (see plan D). Clean any residual flash off the castings, make sure they fit together, and glue them. Paint the rings black (or color them black with permanent marker), and fit them. Paint the entire anchors black. Neatly cut two 36" (1m) and two 12" (300mm) long pieces of the heaviest cable. The shorter pieces are for the smaller anchors. Form a loop around each anchor ring and slip on a 1/2" (13mm) piece of 1/4" (6.35mm) i.d. shrink tubing. Using the cooler part of the shank of a soldering iron, shrink this evenly down onto the cable as shown. Color the central white core of the cable with a black permanent ink marker pen. The large anchors are attached with a small rubber band around the inboard arm and first slot in the fore channels, and another around the stock and the aftermost knighthead. The cable from these heavy anchors is run in through either hawsehole and around the anchor bitts, see attached sketch, and into the hole in the grating of the fore hatch, where it is cut to the correct length and glued with isocyanacrylate. The cable from the small anchors is knotted just inside the hawsehole (out of sight). The small anchors can be stored anywhere you see fit. We don't normally put ours on for sailing, as they're just another hook to get caught. You

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can ensure that the cables drape properly by brushing on matte varnish or wood glue and holding them in the correct loop as they set. The cables should run so as not to foul each other if an anchor was let go.

g. Making the chains

See plan D. The 20 main and fore chains are made from 5 13/16" (148mm) long pieces of 5/64" (2mm) Ø annealed brass wire. With reference to the diagram on the plan D make the first bend in the wire at 45° where the stub end bends out to go around the deadeye. Make a bending jig from a piece of scrap wood. Drill 2 holes as per the diagram and insert the supplied steel pins. Place the wire at the 45° bend between the 2 pins and continue to form it around the 3/8" (9.5mm) pin until you cross over the initial bend. Force the wire on top of the initial bend in the gap between the 2 pins. Put the deadeye in the loop you have formed and close it. We solder the stub end to the main shaft using a propane torch and soft silver-bearing solder (use a heat sink (wet cloth) before the heat can reach the deadeye!). It could be glued with epoxy or just left as it is. The lower end needs to be flattened using a hammer. As the metal spreads out keep it under control by turning it 90° and tapping the wider parts back. When you have a simulacrum of the shape, file it even and drill the 2 5/64" (2mm) bolt holes. Bend the chains to correspond to the athwartship profile. The brass should be blacked with brass blacking or with permanent marker pen.

The 8 backstay chains can be made in the same way, but using the 1/16" (1.6mm) annealed brass wire, and without the deadeye, just leaving the ring to loop the backstay tensioning tie through. These will exert pull, and so the stub end *must* be soldered to the main length of the chains.

h. The capstan

This is made up of the six radial pieces and base plate of 1/8" birch, a piece of 1/4" birch dowel cut to length and the birch driving ring and cap. Assemble with wood glue to match view on plan B. Pin or glue to deck.

3. Mastings:

~Follow these instructions in order. The earlier notes contain lessons and procedures that may need to be applied to the later assemblies. In general the masts are to be sealed with a clear (varnish/polyurethane) finish. The yards can be painted black. Before you start you need to understand how the masts are decommissioned for transport: the two lower masts pivot backward; the entire bowsprit and jibboom assembly unplugs; the main topmast (with the main cap and a piece of the mainmast), the main topmast and pole topgallant mast assembly

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unplugs; the fore topgallant pole mast has its royal top section unscrew. The lowest sections of the masts fit over the mast step blocks inside the hull and are held in place with pins cut from 1/8" (3.2mm) wood dowel; Glue these masts step plates in with polystyrene cement once you have established the correct mast rake angle. The lower masts are sealed to the deck with silicone seal.

a. The Lower Masts and Bowsprit.

i) Three part mainmast: this is finished for you except for the cross holes and inserts below deck for the rigging blocks. Drill the holes and attach the hardware noted on plan C - *you will need to do this for every spar and mast.* The inserts should be a press fit into the wood and then glue the perimeter with isocyanacrylate. Trueness to the athwartships and fore and aft directions is quite important.

~Reference lines can be drawn on the mast by lying it on its side, and running a pencil along it in the correct place.

Drill the holes for (1/8", 3.2mm) and glue in the knurled brass inserts. Cut and bend (sharply) the 1/8" (3.2mm) brass rod pieces for the yard trusses and glue into the masts using isocyanacrylate. Emplace the supplied lower truss collars and seat the mast on its step in the upright and assembled position. The plywood mast hinge plate is fixed into the lower part of the mast with two wooden dowel pins cut from stock. The next hole up gets the removable ABS pin made from stock and the included key ring. Last is the pivot: a stainless steel pin, supplied. Once in place attach the rigging blocks and driver sheet take-up block pad (allow the blocks to swing free; threadlock on the machine screws will stop them from coming out).

ii) Two part foremast: This is the same as the three piece lower mainmast, except that it is all in 7/8" (22.2mm) and there is no separate upper piece or 3/8" (9.5mm) brass connecting pin. Follow the same procedure.

iii) The bowsprit: This too is in 7/8" (22.2mm), just one piece. Drill a hole, cut and glue in an 1/8" (3.2mm) brass pin, as shown, in the lower end. The mainstay attaches to a large cable tie around the bowsprit, held from slipping aft by the cutout in the bowsprit rest. This cable tie needs to pass through the raised deck. Loop a large cable tie through the two slots, slide the bowsprit through the hole at the top of the stem, through the loop formed by the cable tie and into the bowsprit bitts. Thread and tighten the cable tie till you have a loop above deck, when the lower loop is pulled against the bowsprit, of 3/4" (19mm) length. Cut off the excess. Assemble the gammoning: it is made of two large cable ties of roughly equal length loops. The lower one through the slot in the head and around the lower rail, joining in the space between the rails, is left on permanently. The upper one, which loops over the bowsprit and interlocks with this one (pull tight), is the one that is cut each time for decommissioning.

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b. Insert the polypro fairleads and attach the underdeck rigging blocks:

- i) Attach (with machine screws into the inserts that you emplaced when you made up the masts) the four brace rigging blocks, the jibsheet sister block, the driver sheet take-up blocks on their pad and the pad to the mast. All rigging blocks use 1.5mm brass rod as sheave axles. Sheaves must turn freely.
- ii) The polypropylene tubing needs to be bent for the driver sheet fairlead, using the less-hot part of the soldering iron to heat it (experiment with scrap first!) in a smooth curve as shown on plan B. All the fairleads should project to a height of 1/2" (12.7mm) from the deck, and down 1/4" (6.3mm) below the deck. They should guide the lines onto the appropriate sheaves in the rigging blocks. Glue all around each with isocyanacrylate.

c. The lower tops:

These are glued together with wood glue, actually on their respective masts, from the laser cut ply 1/4" (6.35mm) platforms, the 2 1/4" (6.35mm) wood trestletree/cheek combination, the 2 crosstrees from 1/4" x 1/4" (6.35 x 6.35mm) wood stock, and the 1/8" (3.2mm) CNC cut hardwood filler piece, as per plan C. The trestletree should be grooved with an 1/8" (3.2mm) diameter round file, 1/16" (1.6mm) deep to form a rest for the topmast fids (this stops that mast rotating). Adjust the height accurately, glue and pin to the masts. You can now paint these black. Wipe off any paint that gets on the masts.

d. The lower caps and bowsprit cap:

- i) Lower caps: these are pre-cut from 1/2" (12.7mm) birch. Paint black and glue mainmast only with wood glue, cross pin with 3/32" (2.4mm) brass rod as shown on plan C (note the hook for the antenna; (knot a rubber band onto the antenna wire to attach and detach here). The foremast cap must be affixed after the shrouds and stay have been put around its head.
- ii) Bowsprit cap: this is pre-cut from 1/2" (12.7mm) birch. Paint and assemble onto bowsprit as with above. Drill 1/8" (3.2mm) hole 1/2" (12.7mm) deep, through bottom of cap into bowsprit for dolphin striker. Cut 1/8" (3.2mm) brass rod to length for dolphin striker. Hammer flat small area at distal end and drill with 1/16" (1.6mm) drill for martingale stay. Shape, if you desire, with a file. Deburr edges of hole and use wood glue to glue striker into bowsprit cap, as shown on plan C.

e. The topmasts and jibboom:

- i) Topmasts: drill as shown in plan C. They should be coated with a clear sealer. Cut and bend (sharply) the 3/32" (2.4mm) brass rod pieces for the yard trusses and glue into the masts using isocyanacrylate. Cut the topmast fids from 1/8" (3.2mm) brass rod. Emplace the supplied lower truss

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collars. Emplace the masts and fids and drill the lower caps through the center of the topmasts for 3/32" (2.4mm) brass pins. Cut the pins and press in flush. Remember, the foremast assembly has to wait for the shrouds and stay.

ii) Jibboom: drill as shown in plan C. Glue the CNC cut jibboom saddle onto the bowsprit, and slide the jibboom into place. Drill through the center of the jibboom and saddle, 3/4" (19mm) deep, cut an 1/8" (3.2mm) piece of wood dowel and use to pin. The jibboom is not glued. The saddle pin is sacrificial and will allow the jibboom to absorb a large frontal impact without breaking, only requiring a new saddle pin (so make a couple of spares).

f. The topmast crosstrees and caps:

i) Topmast crosstrees: these are very similar (the main trestletrees having a different angle of mast groove from the foremast ones) and are glued up around the topmasts, using wood glue from the two 1/4" (6.4mm) trestletrees, the three birch crosstrees and the 5/32" (4mm) black ABS or marine ply filler piece. The trestletrees should be grooved with an 3/32" (2.4mm) diameter round file, 3/64" (1.2mm) deep to form a rest for the topgallant mast fids. Once assembled paint black, wiping excess paint off the mast.

ii) Topmast caps: these are both the same, pre-cut from 3/8" (9.5mm) birch. Paint black and glue on with wood glue. Pin to topmasts with cut 3/32" (2.4mm) brass rod.

g. The topgallant pole masts:

Drill both for pins & etc as shown in plan C and emplace (isocyanacrylate) the stops, cut from 3/32" (2.4mm) brass rod. They can protrude 1/8" (3mm) either side. Cut the yard trusses, bend (sharply) and glue in with isocyanacrylate. Glue the trucks on, after the masts are sealed, with a minimal amount of 5-minute epoxy. Slide into the topmast caps and crosstrees, emplace the fids (cut from 3/32" (2.4mm) brass rod), and glue and pin with cut 3/32" (2.4mm) brass rod.

h. The driver and gaff booms:

i) Cross drill holes in booms as shown on plan C. Paint black; cut the black latex tubing to length (1", 25mm) insert the gooseneck brass pin (1/8", 3.2mm) and slide the tubing on to the pin. Attach to the mainmast hinge tongue fitting.

ii) There are two gaff booms, one for the reefed driver, one for the full. Drill and emplace hardware as shown on plan C. Make up the two sets of gaff halyards by seizing both ends of the line as described below in "shrouds", and leave them attached to the booms.

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4. Standing Rigging:

a. The lower shrouds

~Shrouds are made in pairs, looping over the head of the mast, which they are seized around, then running down to the deadeyes, which they are also seized around. So the first starboard mainmast shroud forms a pair with the second starboard mainmast shroud. Shrouds are tensioned by the lanyards running between the upper and lower deadeyes. They are formed into an integrated whole on each side of each mast by being connected with a ladder work of ratline that is glued and knotted to each shroud. The parallelism, correct tension and straightness of these ratlines is a large feature in the appearance of the ships. Making them will be tedious, so just do one at a time and move to other tasks.

i) Deadeyes and chains: Form the required number of chains around their deadeyes as shown on plan D. The brass wire comes annealed, but as you work it it will harden: anneal it again by heating it with a propane torch until it becomes red for a moment, then allowing it to cool. If it is too soft to start with and you cannot easily make it straight, hold one end in a vise and pull and twist the other end. Color the brass black (we use permanent-ink marker pen). Line up the length of the chains with the direction of the shroud it belongs to that comes from the masthead. Mark a line on the hull where you are going to drill the flattened lower end of your chains and tape each chain in place with its deadeye held in the loop above the channels. trim them and bend them until they are neat, then drill the two holes and glue in the chain plate screws.

ii) Shrouds: Take a piece of shroud cable, cut it long enough to wrap around your mast and down to two adjacent deadeyes, and seize it tight around the masthead and the deadeyes. You can attach the top deadeyes at the right height from the lower ones with a piece of line or bent rod.

~To seize line, cut the correct diameter (it should be the closest to a snug fit) adhesive-lined heat-shrink tube to a length representative of 3 times (it is *6 times (+/-) for all but the shrouds*) its finished diameter. (Do a couple of practice pieces first). Slide it over the two ends and pull the ends tight, clamping beyond the seizing with an alligator clip or clothes' pin. Heat the shrink-tubing evenly with the cooler part of an electric soldering iron, until it shrinks down tightly and smoothly. Put a drop of isocyanacrylate in each end and accelerate. Accelerating isocyanacrylate should be done with the tiniest whiff of mist from the spray bottle; more will crystallize and weaken it. Trim off the excess shroud and color the white core black with permanent-ink marker pen.

Complete the other side, then the next pair, alternately port and starboard.

iii) Deadeye lanyards: (there are 2 sizes of lanyard - keep them distinct), knot one end with a half knot and cut to length. Remember, you'll need a knot in the other end too, so what we do is *mark* the

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length from the first knot then cut an inch (25mm) past it. After threading, tie the second knot so it pulls down to this mark, then cut off the extra. Thread between the upper (seized into your shrouds) and the lower (held by your chains) deadeyes as shown on plan D.

iv) Ratlines: The first shroud is omitted from the foremast and on the mainmast the first shroud gets no ratlines. Pre-cut the required number. Knot them, using half-knots around the (second) shroud at the correct spacings (9/16", 14mm), and glue with a tiny drop of isocyanacrylate. Loop each ratline around each shroud in turn, and half-knot to the aftmost, without worrying about neatness yet. The line is on the *outside* of the shrouds. Adjust the knots and spacing until it looks even. Glue each knot and loop with a tiny drop of isocyanacrylate. Trim the ends of the ratlines close.

b. The upper shrouds

Just the same as the lower, with the exception of the chains. The lower deadeyes, once attached to the lanyards, are complete. Hook them into the correct slot on the tops. No futtock shrouds are designed into the model.

c. The stays

See plan D. Seize both ends, the top around the mast heads, to the lengths determined by your model (it is not too critical; you'll be able to adjust final length with the cable ties). Attach the lower ends to the points as shown. The mainstay and forestay both use large cable ties, the remainder use small. The lower stays do not pass through the oval holes in the platforms of the tops (which are, in real life, for the yard slings) but through the forward end of the lubbers' hole.

d. The backstays

See plan D. Seize both ends, the top around the mast heads, to the lengths determined by your model (as above, it is not too critical). Attach the lower ends to the backstay chains with small cable ties. The chains are then threaded through the aft holes in the channels; do not tension yet. Make sure they are lined up with the backstay above them and their upper loops rest against the channel (you will have to file out these holes a little to accommodate the return piece of the brass loop). Mark the points to drill the attachment bolts. Drill all holes, then glue in the bolts; tension the backstays with the cable ties. The cable tie represents the deadeyes and their lanyards.

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5. The Spars and Sails:

~We use rubber bands at sail clews and in various other places because they are so easy to use. You can substitute thin elastic line (from a sewing store), maybe dyeing it a manila color. This will save you having to replace the rubber bands which deteriorate quickly in sunlight.

a. The mainyard

Now, we rig the mainyard without any sail. If you want to attach a furled sail to it (which would be equally correct), there is enough sail material. Drill the yard and attach hardware as shown on plan C.

~Furled sails are made with unprinted material. The material needs to be the same breadth as the head of a full sail and about the same depth. You can add material (nylon) when rolling up the sail, since in real life the actual thickness of the canvas would be proportionately greater than we use at scale. Glue (isocyanacrylate) the top edge to the yard. Fold the sail as illustrated in plan D. Tie the furled sail onto the bottom or front of the yard with neatly trimmed knots in 6 evenly spaced places, using .028" (.7mm) manila running rigging line. On topsail and topgallant yards only, knot (and glue this knot, as with all fixed knots, with isocyanacrylate) a length of the same manila rigging line onto the lower yardarm eyes. Seize the lower end to form a loop, making sure the overall length is the correct spacing to reach the clew eyes on the yard below once you have attached a rubber band and rigging hook (see plan D). Note: the yards change position when the sails are furled and rest on the *lowered yard* trusses. The topgallant yards need two sets of these attachment lines: long for when the yard below is lowered and short for when it is not. The lines not in use can be left tied around the furled sail.

b. The foreyard and the forecourse

The ss spring wire is pre-bent for you but not cut to length. It can be cut with bolt cutters or a hacksaw. Once you have the holes etc. in the foreyard, slip the wire in, mark and cut to length using the sail outline as a guide. Cut out an additional piece of sail cloth to make the foot seam. It should have the same bottom edge as this sail and the top edge should be parallel about 1" (25mm) above that. To cut sail material see below under "loose sails". Sew this piece to the flap at the foot of the sail so that the seam line is on the sail edge and the hem is inside. Sew the two sides of the sail, making a stitch line parallel to the printed seam lines, even on top of the appropriate one, if possible. Slide the wire through the two edge seam sleeves, fold the foot piece over and sew parallel to the foot. Tuck the corners in neatly and sew down. Add the styrene strips (as below) and assemble the sail to the yard.

Make a small hole in the center of the foot of this sail, just above the wire; we use a soldering

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iron or heated piece of brass tubing so that the edges seal. Thread a rubber band through this and hook it to the brass hook on the aft side of the fore raised deck.

c. The topsails and their yards

Both topsail yards need to be made with furled and loose sails. Drill and emplace hardware in the four yards as shown on plan C. Attach the furled sails as described above in “the mainyard”.

~Loose sails should be cut out of the supplied material using a “hot-knife”, or cut with sharp scissors and then edge-sealed using the cooler part of a soldering iron. This heat sealing is important as it stops the material from fraying. Note that the sails have an extra “flap” at their heads. Cut the supplied styrene strips to the same length as the head strips and glue one to the other, using isocyanacrylate, without creating lumps. Insert the head strips and sail into the slit in the bottom of the yard; make sure they are centered. The side screened with the ink showing should be forward. They are necessarily a tight fit; be patient. Glue in with small amounts of isocyanacrylate. Add the tabling as shown in plan D. Tabling is adhesive backed. Cut to size and check fit with the silk-screened lines first, then remove backing and stick onto the aft side of the sail, using pressure. Pierce the sails at their clews as shown, using either an 1/8” (3.2mm) hole punch (that’s what we use), or a soldering iron (practise). Attach small rubber bands into the clews and then rigging hooks to them. See plan D.

d. The topgallants and their yards

As for the topsails

e. The driver sails and booms

You have made the two driver gaff booms, one for the full sail and one for the double-reefed sail. Cut the sails as above. Glue the heads of the sails into these booms as with the square sails, but here the sail comes flush with the untapered end. The clew and tack get rubber bands. The clew, aft, gets a hook and attaches to the boom. The tack, forward, is attached around the brass “gooseneck” pin and the mast. Attach the full sail to the rigging eye on the mainmast, its halyards to the cap fitting and its clew hook to the driver boom.

f. The jib

Sew the luff (leading edge) add the tabling, pierce for the clew and the peak, add the rubber band and rigging hook. Slide the sail onto the jibstay and tie to the jibboom using a sewing needle and manila-colored sewing thread to form a loop through the doubled part of the sail and around the boom. Using .028 manila line create a halyard seized in at the peak. The other end ties (so it is

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adjustable) onto a rigging eye under the first crosstree.

g. The Ensigns and Pennant:

The ensigns should be cut out like the sails, but leave a 3/8" (9.5mm) wide rectangle the length of the hoist edge of the flag. Fold this in half and sew along the edge of the flag field. This now makes the header for the flag through which the halyard is rove and/or clipped to. The halyard runs between the halyard eye at the aft end of the gaff boom and the outboard clew eye on the driver boom. Ensigns do not necessarily have straight edges due to the limitations of the screening process on polyester. The pennant is cut from the material provided (see plan D) and the hoist folded over and taped with clear tape to make a tight fit around the main topgallant pole head under the truck. It is used for gaging wind direction.

Now starting at the bottom, attach the yards and sails to the masts. The yard trusses get a collar both above and below the pivot eye on the lower yards and just the one below the eye for all others.

6. The Running Rigging and the Servos:

You have already attached the rudder servo (1.g.)

All running rigging is made up of .028" (.7mm) manila line. The three large servos have to be screwed down to their respective blocks after their arms are attached to the "horns" that are already on. The brace and sheet arms are attached with 2 bolts (from the bottom up) secured with washers and nuts as shown in plan A. You should not replace the Hitec 815BB servos with alternates as they rotate through 140° rather than the standard 120°.

a. The Braces:

The upper end of each brace is knotted (round turn & two half-hitches) and glued around the supplied grommets. This connection should not extend back along the brace, but be as snug as possible to the grommet - otherwise it will limit the brace travel as it is pulled back into the brace guide. These grommets attach to the opened eye hooks on the yard. The braces are port and starboard for the mainyard and foreyard. These yards are connected to the yards above them by the clews of the sails above or by clew lines for furled sails, so that when they turn, the yards (and sails) above turn. The braces lead from the brace eye on the yard, through the brace guide, down the back of the mast (through the upper gaff eye on the main, and through an eye in a similar place on the fore), through the polypro brace fairleads in the deck aft of the mast, through the rigging blocks and so to the rigging adjusters on the end of each servo arm.

The lower end of the brace is knotted and glued (after final adjustment) to the rigging adjuster.

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~These adjusters are designed to work thus: tie the line to one end hole; place the middle of both adjusters on their bolts which run through the end holes on the correct servo arm; adjust the knots so both the yard controlled and the servo arm are athwartships simultaneously. Later adjustment is made by moving the adjuster bolt to another hole.

b. The Fore and Aft Sheets:

The jib sheet runs from the jib clew through a rigging eye on the upper side of the bowsprit, through the rigging sister block on the forward side of the foremast, down through the polypro fairlead, through the rigging block and so to the rigging adjuster. A 1/4 (7gm) or 3/8 ounce (10.6gm) fishing weight is hooked onto this line between the polypro tube and the rigging block. This is to keep the sheet from snagging things when it is let out but there is no wind on the sail.

The driver sheet runs from the clew eye on the underside of the boom through the raised deck polypro fairlead through the 2 rigging blocks on the pad on the mainmast (a fishing weight is required here too) and so to the rigging adjuster on the starboard side of the sheet servo. Sheets need to be checked so that the weights do not jam in between the blocks when pulled tight.

c. Set Up of the Radio Control

See the wiring diagram. The fusing is not essential but is very strongly recommended. The 815BB servos need to be directly wired through the “Y” patch cords to the battery as well as the receiver. You will need the additional wire provided to reach the battery from one side of these “Y” cords. The 645MG servo can be plugged directly into the receiver via the extension cord.

We do not recommend the on/off switches that come with the radio sets, but rather unplug the wire connection to the battery. If you would like to install a switch, choose one for the marine environment and install it between the positive leads and the battery positive terminal as shown, possibly sticking through the deck, but at least high up in the between-decks.

Our HiTec servos come equipped with “S” connectors. **Polarity** (yellow wire lines up with yellow wire etc.) has to be assured visually. Connecting servos “backwards” will destroy them. Avoid turning these powerful servos by hand - you can put too much force on the gear train.

All connection places in the wires should be fastened (we use Velcro) to the underside of the deck, as should the receiver. Solder joints must be shrink-tube protected. We use automotive-type blade fuses. The receiver antenna should be run up through a polypro fairlead in the deck (seal the hole with silicone sealant) just afore the mainmast and the end fastened to an eye in the main cap with a rubber band.

Running rigging that goes to the servos should not be too short so that the servo cannot reach the end of its travel, nor should the servo arms or the rigging attached to them catch on anything since

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either condition can burn out a servo and/or melt the wiring. Center all the transmitter's trim levers. Now, with the transmitter stick all the way to one end, make sure the trim lever is still able to move the servo arm further. Check each direction of each servo. You can also do this with a multimeter (enabled to measure 5 amps - you usually have to put the positive plug in a different jack on the unit) connected between the battery and the positive lead to the receiver and servos. You should have 0.3 (preferably) to 1.2 amps (maximum) of drain at the extreme positions. Braces are tightest with the yards athwartships and so the drain is largest (2 amps) in this position.

If using a "standard" radio we remove the return springs from our transmitter gimbals, except for the rudder, so that the control sticks stay where they are put. The 7 amp hour lead-acid batteries last us between 4 and 12 hours of sailing, but we *always* take the battery out after a sail and recharge. Once the radio is working properly, make sure the servo arms are athwartships and the rudder servo plate is symmetrical around the fore & aft centerline of the ship when the joysticks are in the neutral (centered) position. This can be adjusted by removing the central arm screw, lifting the arm off its splines and putting it back on in the correct position and then fine-tuning with the trim slider on the transmitter.

Lastly, we gather all the cables and receiver and slip them into a small re-sealable plastic bag, closing the top as much as we can, then seal it with duct tape and tape it to the side of the sheet servo. We take extra precautions because we sail mainly in saltwater.

7. Assembly of the Launching Cart

Coat the whole axle (it is not ss) with some durable water-repellant material (we use vaseline) and set the axle down on scrap paper or cardboard. Insert ss cotter pins in the two innermost holes, slide a large ss washer onto each end and then place the cart sides onto the axles. See attached sketch for the correct holes to use. Knock the three cart cross-beams into their triangular holes with light taps of a hammer. Ensure that they seat properly (the sound of tapping them becomes solid). Insert the handle into the sides and attach with the four Phillips head 1/4-20 machine screws and nuts (they are not ss). Attach the two cradle pieces with 6 3/8-16 ss bolts and nuts. They go on the outside of the side pieces. Push the bolts through from the outside. Put a large ss washer on each end of the axle, slide the wheels on (protruding hub inside), then another washer, then two ss cotter pins through the axles to hold the wheels, bending the long arm to retain them. Lastly press the two black ABS cradle cross pieces into their interlocks on the cradles (slot goes to slot).

Congratulations!! You are finished. Please let us know....

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8. Commissioning and Decommissioning the Ship:

Decommissioning in the launching cart:

(Please note that this assumes you do not use cable ties on the main topmast and topgallant mast stays, but rather bend the respective rigging eyes into hooks and just slip the seized stay loops over them.)

1. unscrew the ballast keel barrel-nuts. If you chose to unscrew the keel rods from the keel and remove the barrel-nuts and keel rods as a unit (easier), ensure that you thread the rods into the keel at least three complete turns before sailing. If one comes loose it could mean the loss of the ship.
2. remove the sails (unhook the sheets and brace grommets) with their spars.
3. cut the cable ties to the
4 main mast/topmast backstays
mainstay
forestay
2 bowsprit shrouds and bobstay
gammoning
4. slip off the main topmast lower deadeyes

9. Sailing:

Included with your kit is a brief synopsis of sailing techniques from Harland, "Seamanship in the Age of Sail".

The ship will sail marginally above her waterline, however, you can adjust this balance by adding weight (we use lead shot in re-sealable bags).

The braces must move the yards until they press against the first shroud at 45° from centerline of ship. The rudder must move at least 30° from centerline in each direction. The fore and aft sails are the last thing you should worry about adjusting when you are learning to control her with your radio. The rudder is the most critical. You will most often be sailing as close to the wind as you can when you begin, so as not to lose sea-room. Close-hauled like this you need to keep the two braces all the way in on the lee side. On "standard" radios we use the left stick right-left for the rudder, up-down for the main brace, right stick right-left for the sheets, up-down for the fore brace. On the ACE Hobby Nautical Commander radio we use the two up-down sticks for fore- and mainbrace, the centering left-right stick for the rudder, and one of the side mounted slider switches for the sheets.

The tension of the rubber bands that hold the sails to the yards below them is significant. Tight and she will be more weathery, looser and she will look more realistic.