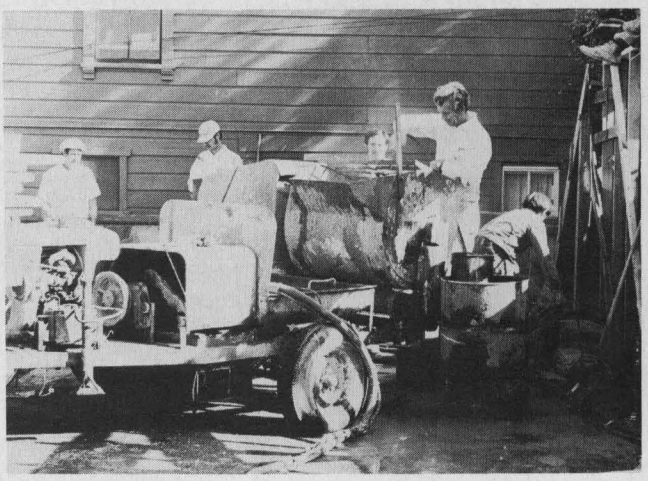
HOW TO BUILD
FLICKA

PART FOUR
PLASTERING THE HULL

By Bruce Bingham and John Daniel



Shortly after sunrise while it is still cool and still, John and his crew prepare the first batch of mud for Flicka.

□ Hand plastering is a fatiguing exercise that demands strong backs and arms. Many boat builders bring in professional help at this stage, but we are going on the assumption that you plan to do the job yourself with the help of friends.

Make sure you have food and coffee on hand for the entire crew, and try to have a crew large enough to allow sufficient rest periods for everyone. Arrange for "squad leaders" to oversee specific operations and keep things moving, and pair your "experienced" help with the novices so they can share on-the-spot advice.

Above all, plan the job carefully ahead of time so that each step is easy to explain and execute, and the overall operation moves along at an easy-going (but efficient) pace. This is a time for togetherness.

MIXING

It is difficult to say that one aspect of plastering is more crucial than another (mixing, penetration, finish, sculptured detail), but careful mixing of the proper ingredients is the basis upon which the other procedures will depend. It dictates the workability of the mortar, shrinkage upon cure, smoothness of the surface and (in part) the strength of the hull.

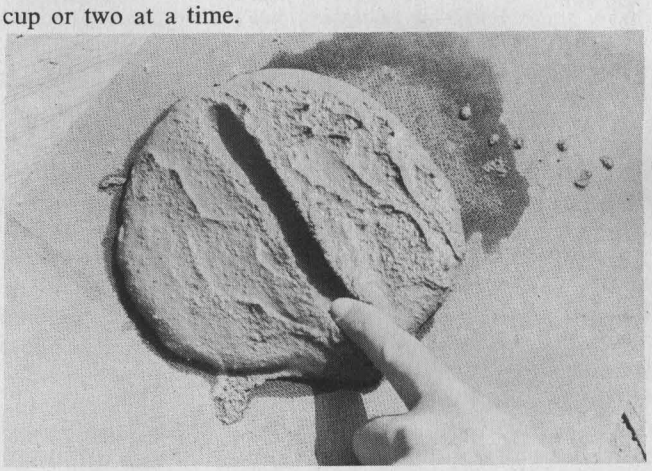
It is imperative that the first batch of "mud" be the same as the last in every respect. To slow down the mix with extra water as the day warms is the worst thing you can do, but I've seen this done a hundred times. This is where premeasuring is important. On plastering day it is impossible to continually stop the mixing in order to weigh ingredients accurately. Have your sand, cement and additives laid out in order of use before fixing up the machinery. It will eliminate errors caused by last-minute confusion.

Never mix more mortar than can be used conveniently. If your batching crew gets too far ahead of the hull crew's requirements, the mortar will simply take-up in the buckets before it's used. Never trowel any mortar which is more than a few minutes old and dump that which has been allowed to thicken. Never mix old mortar into a new batch. Never thin old mortar with water to make it workable as it will lose a great amount of its finished strength. Once the ingredients have been completely and evenly mixed (usually four to five minutes) turn the machinery off. Over mixing will only break down the cement crystals and entrap large quantities of air.

The proper sequence of mixing should be carefully followed. Deviations may cause lumping of the mortar or concentrations of ingredients.

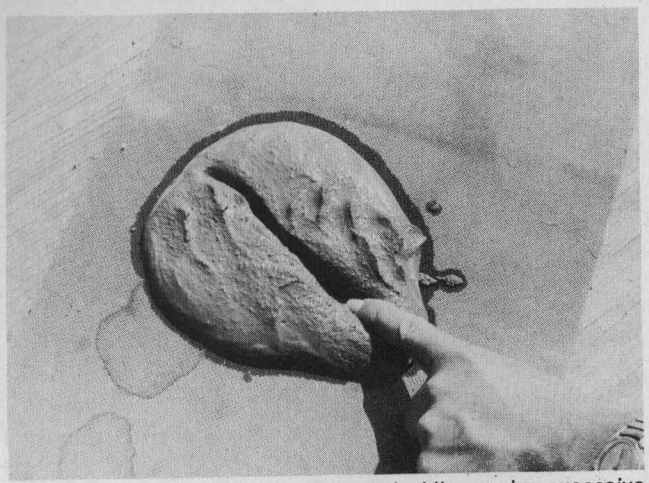
1) Pour about 80 percent of the water into the mixer (26 pounds)
2) Add pre-measured amounts of Pozzolan and admixtures.
3) Pour in one bag of cement (94 pounds).
4) Add two bags sand (188 pounds dry).
5) Begin pouring the remaining water but only until the mortar becomes workable. If you use less than you have pre-measured, the result will be a stronger hull. The less the better. Try to keep it below a total of 30-32 pounds.

As soon as the batch seems ready, pick out a handful and place it on a board, then draw your fingers across the surface of the mortar. This should leave a distinct impression of your finger without causing the mortar to crumble or flake. If crumbling does occur, the mix is just a bit too dry and would be difficult to work. This requires adding a small amount of water but don't just pour it in. Use only a cup or two at a time.



Careful addition of premeasured water will ensure a strong but workable mortar. Note that the mortar leaves a distinct finger impression without filling in. It's a good mix.

If, on the other hand, the mortar tends to fill in behind your finger, you've used too much water. Of course, you don't have to throw this batch out because it will be good for the less structural areas of the hull or where penetration may be especially difficult. Remember that too wet a mor-



Too much water will weaken the vessel while causing excessive shrinkage. Note how the finger impression fills in behind itself. The mortar is too wet.

tar will cause excessive shrinkage and possible hair-line cracking.

Keep an accurate record of all mortar batches as well as notes on workability and viscosity. If any changes are required from the original batch, they should only be very minute and these notes will serve as a guide.

Another method of determining a proper mix is called the "slump test." This consists of forming fresh mortar into a slump cone (available from your cement supplier) and then packing it with rod or stick to ensure settling and escapement of trapped air. Once the mortar is fully packed the cone is carefully removed. After about 30 seconds, measure the degree of slump (drop) from its original height. This should not be less than 1¼" (dry) but not more than 2½" (wet.)

PENETRATING DIFFICULT AREAS

Obstacles within or behind the armature always create the possibility of voids in the finished hull. The areas of the center pipe, chain plates, corners of bulkhead webs and tanks, machinery or sole brackets, stem reinforcement or where extra rod and mesh have been used, deserve particularly careful mortar application. Plastering these trouble spots should precede the filling-in of the remainder of the hull but not too far ahead of the pushers as you don't want this initial mortar to dry out.

If you are plastering to a partial mold system, it is vital that you completely penetrate the hull in the areas of ribbands or solid molds when they are relatively visible. Massive voids will result if you don't concentrate on these areas first.

Begin by applying a sufficient quantity of mortar to the hull with a bucket or trowel then force it into the armature with a gloved hand from both sides if accessible. You will be surprised at how much mortar these areas can absorb, so continue to add mud until it appears to back out through the mesh. Do not attempt to cover completely at this time but only to a point where the mesh pattern is somewhat visible. You may vibrate these areas slightly but use restraint.

The deadwood always creates problems. It may be impossible to work this area from the inside of the armature because of the lack of room but do have someone positioned for observation of penetration (open mold systems).

Push, push, push is the action necessary to achieve proper mortar penetration, a prime ingredient for a strong hull. Note the distinct "shingle" pattern caused by the trowel action. Do not attempt to cover the mesh completely at this stage.

The deadwood, designed to be almost solid concrete, will require many gallons of mortar and because of this quantity, it is best applied with a trowel. The technique is first to lay a one-in. thickness over the armature then push-push-push-push until the mortar is completely absorbed into the hull. Hold your trowel at a slight angle to the armature and move it upward a few inches with each thrust, resulting in a distinct shingle pattern. You may have to repeat several layers of mortar to insure penetration but do not attempt to cover the mesh completely. Stop when the mud appears to be backing out through the armature, leaving the mesh pattern faintly visible. You may vibrate the deadwood area slightly but use your gloved hand whenever possible. Strive to achieve a good bond against the rudder tube or weldments.

PUSHING MORTAR

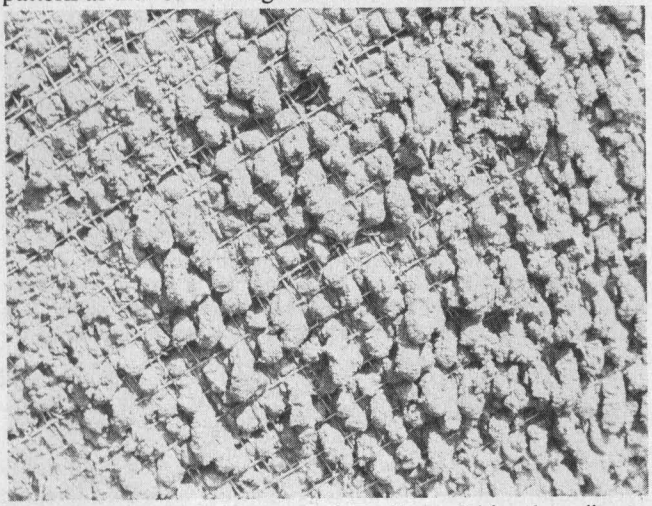
Once the difficult areas are completed, the remaining exposed armature must be penetrated. Pour about three gallons of mud at a time directly onto the hull and immediately spread it to a one-in. thickness. Holding the trowel at a slight angle, push-push-push-push the mortar into the armature, moving the trowel up a few inches at a time. Once again, a distinct shingle pattern will result. After pushing the area once, repeat the process as many times as necessary to force all the mortar into the armature. Additional mortar should be applied until it tends to back out through the mesh surface. Do not attempt to cover the mesh completely but only to achieve a faint armature pattern.

BACK PLASTERING

If you are plastering to the recommended open mold system (mold removed), your penetration is assured when the mortar oozes through the opposite side of the armature. A back-plasterer positioned on this side should be calling signals to the pusher so as to inform him of the quantity of mud required and degree of penetration. When the oozing has consistently passed through the armature and forms

Continued on next page

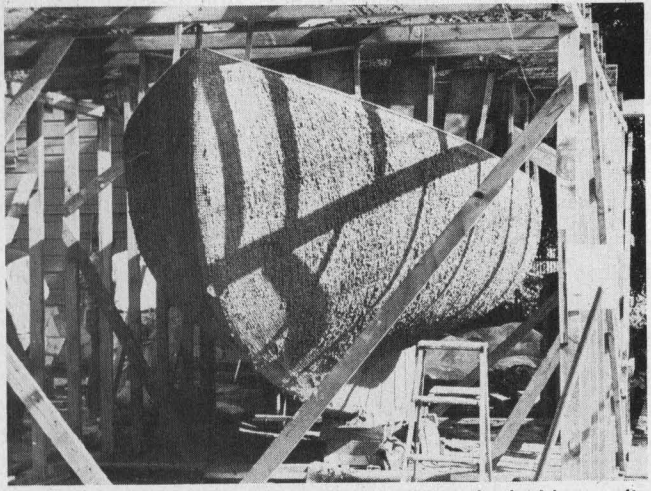
nipples (⅜ in. at each mesh square), the back plasterer should tell the pusher to move to a new area. Once the plaster has taken a slight set, the back plasterer may trowel the mortar back into the armature. It is not sufficient to simply skim-trowel when back plastering as this will surely trap air under the surface. It requires the same pushing technique as previously described without attempting to cover the mesh completely. The back plasterer may apply additional mud as required to achieve the same faint mesh pattern as that of the original side of the hull.



Good peneration can be seen from the outside of an "open mold" hull. With closed or "cedar" mold, this may be impossible to achieve.

PENETRATION OBSERVATION

If you are plastering to the inverted system, your mold will have been covered with a polypropylene sheeting. This sheeting precludes any possibility of back plastering but men should be stationed inside of the mold to ensure that the mortar is completely filling-in behind the mesh. Pushing mud will require additional care and it may be necessary to vibrate each area slightly as you go. Do not move on until all air pockets against the polypropylene are completely filled. To aid this filling, the observer may occasionally cut a small slit into the barrier to allow for air escapement which might otherwise be impossible.



Flicka, hull now completely penetrated from the inside, awaits back plastering to complete mortar impregnation. Note the consistent "nippled" texture caused by pushing mud through the armature.

POSITIONING YOUR MEN

Assuming that your entire team is comprised of amateur labor, and that you are not using a pump gun or gunite to achieve penetration, place your pushers (and back plasterers) so they are not required to finish a larger area than 100 sq. ft. To attempt a larger surface would surely cause the hull mortar to set up before you are ready for the skim coat.

It is best to locate an upper and lower team (except on very small hulls) so they do not have to scale the stage or change position. A lot of time and energy can be wasted in unnecessary climbing about. Set your teams so they overlap their areas and make sure that they can reach onto adjacent territories for the purpose of blending the boundaries harmoniously.

Of course, for open-mold plastering, one backplasterer accompanies each of the pushers and they work in pairs throughout the entire day. For full or cedar mold construction, the entire team works from the outside of the hull.

SKIM COAT

After you have achieved total penetration over all areas of the hull, the skim coat follows. This should not be done immediately, because the mortar on the hull will probably be too slack to withstand the additional trowel pressure without affecting its bond to the armature. You must wait until the hull has taken a rather firm set. The timing here is quite critical but you can tell the proper moment with this

The "palm" test is a good way to determine the right time to apply the skim coat. Allow enough lead time to mix your mortar. This builder has chosen chicken wire mesh at the cost of strength, but his penetration looks perfect.

easy test. First, place the palm of your hand against the hull and press gently. Now lift your hand. If you have left a palm print on the hull, the mortar should set a little longer. If no print appears, pull your hand over the hull surface. If this leaves a roughened track, your hull is ready to skim coat. If, when dragging your hand, no track is left, you may be too late, so continually check the mortar take up until the set is just right. This may be as much as several hours after completing your initial penetration so it may be a good opportunity to break for lunch. However, consider also the time difference between your first penetration area and your last.

The skim coat requires the use of the hawk to carry small amounts of mortar and to scrape off the excess from your trowel. Some masons prefer to "flick" the mortar by hand evenly onto the hull while others may simply begin by

spreading an evenly thin layer over the surface. The trick is to achieve a consistent thickness of about 3/32 in., but if you feel a divot as the trowel glides along, add just a little bit more mortar. If this requires more than ⅛ in. thickness do not attempt to fill the divot completely as the skim coat will become very weak in these areas. You will fair them over with grout on another day. Many good hulls have been ruined by over-plastering for the sake of fairness when the correction should have been accomplished by other methods.

An important factor to remember when skim coating is to *not* attempt to achieve a perfectly smooth finish. Don't worry about light trowel marks or occasional overlaps providing they are not excessively deep. You should be concerned only with covering the mesh adequately and uniformly. If you are plastering to an open mold system, skim coating will take place on both sides of the hull simultaneously.

FISH HOOKS

Regardless of how careful you may have been during the days prior to plastering, you will certainly have left an occasional loose end of mesh or wire tie exposed above the armature surface. You will discover these as you penetrate the hull but little correction can be done at that time because of the lack of rigidity of the mortar. At the time you apply the skim coat, however, the inner mortar will have taken up sufficiently to hold these fish hooks once they are pushed into the hull. Troweling during the skim coat will reveal these fish hooks once again and they may be remedied by forcing them into the armature with the flat corner of your trowel. Do not attempt to hammer them. If this doesn't do the job, you have to leave them until it's time to grind the hull. But you will find that in the majority of cases this action is not necessary.

INITIAL SCULPTURING

It is during the application of the skim coat that you should begin shaping corners, edges and small, solid units. The inside of tanks, bulkheads, etc., may be formed with a large salad or serving spoon. Putty knives may be used for getting into tight spots or to cut away mortar which has lapped onto the through-hull blanks. The putty knife may also be employed at this time to clear mortar from metal parts which are to be left exposed.

If your hull is designed to receive the "U" shaped heel bearing plate, it must be fitted at this time. First apply a liberal amount of mortar to the base of the deadwood in the area of the bearing. Now, carefully tap the bearing plate into its proper position, making sure that it aligns with the rudder tube. Hold a vibrator against the bearing plate briefly to ensure against air pockets, then scrape away any mortar that encroaches onto the exposed plate. Fair the hull in the area of the bearing so as to create a continuously smooth surface across the mortar/metal joint. Leave the bearing in position for several days after plastering, then remove and allow the hull to cure fully in this area.

I don't believe that the transom corners or bow should be fashioned to a sharp edge as they are extremely vulnerable to chipping throughout the service of the boat. Some boats are designed with a large radius at the stern and no attempt should be made to change this. The corners of the transom should bear approximately a 1-in. radius as well as those of the cabin structures and cockpit perimeter (as applicable).

If your vessel is to have ferrocement decks, the sheer line must not be allowed to form a sharp edge. This is the most dangerous area on the boat for eventual chipping. A 1-in. sheer radius also reduces chafing of dock lines. If the boat is to have wood decks, the edge of the hull will be dictated by the sheer screed.

Any surface which is to receive flat hardware or flanges (some types of stuffing boxes, cleats, through-hull fittings, etc.,) must be finished perfectly smooth. The strength or water-tightness may depend on this detail.

If any ferrocement webs, flanges or other sculptured details are to be left exposed within the hull, do your best to make them good looking, clean and free of bumps. It is always a good idea to put an artistic friend to this task as a heavier, less sensitive hand may produce a totally unprofessional appearance. Keep in mind that grinding cured concrete is an exhausting job which can easily involve weeks of back-breaking work. Save yourself this punishment by looking ahead to this chore and correcting the imperfections at this time.

THE HARD TROWEL (FINISHING)

This operation is the finishing touch and must be attempted by your most experienced hands. Once again the timing of the set is extremely critical and the palm test (previously described) should be used to determine the proper moment to begin. The purpose of hard troweling is two-fold: to "knock off" any trowel marks which have been left in the skim coat and to create a satin smooth surface. The first effect is accomplished by holding the steel float at a slight angle to the surface and scraping it across the hull with a moderate pressure. When the trowel marks have been removed, hold the float flat against the hull then glide it back and forth until the surface begins to shine. Use long, graceful strokes. Do not be deliberate with your motion but sway to and fro, with rhythm and finesse.

John and Steve Daniel apply approximately 3/32" of fresh mud for Flicka's skim coat. With her mesh just barely covered, she begins to take on a sheen befitting her beauty. Once slightly set, the skim coat will be "hand troweled" for her final smooth finish.

SPONGE FLOATING

The purpose of the sponge float is to roughen the hull slightly in order to provide a firm grip of the epoxy sealer. After dampening the sponge float slightly, pass it gently over the entire hull. Do not use pressure. This raises the aggregate on the surface leaving a consistently sandy texture while knocking off the visually pleasant sheen. I believe that a shiny concrete finish is detrimental to the effectiveness of the sealers and I recommend this procedure highly. Sponge floating takes neither skill, muscle or time and can be done in but a few minutes on most hulls. □