The birth of a new boat **PART 4**

Building the deck plug

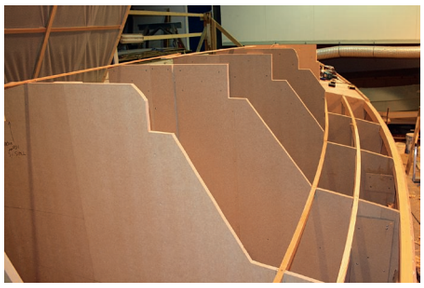
In part four of our series following the building of the new Cornish Crabber 26, David Harding shows how the deck plug takes shape

Building a deck plug is a complex and time-consuming business. When you consider the contours of the coachroof, cockpit and anchor well, plus all the detailing for the winch and hatch plinths, coamings, grab rails, scuppers and so on, it's little wonder that a deck plug involves more work than a hull plug. For the Cornish Crabber 26, it took just short of eight weeks.

The fundamental structure is the same as the hull plug: it starts with a framework of (in this case) timber and MDF, the frame is covered with plywood, and then it's painted, filled, faired and waxed ready for the mould to be laid up on top of it. The plug is the 'male' form, resembling the shape of the finished boat. From the plug the female mould is made, and inside the mould the final moulding is laid up that forms the structure of the production boat itself.

When Cornish Crabbers built the hull plug, they started with sections (athwartships members) that formed the basic shape. Some of these sections extended above deck level, so when the mould was lifted off and the plug turned over, part of the deck structure already existed. The sections weren't all high or wide enough for the full coachroof, however, so with the plug the right way up Crabbers' first job was to extend them. Next came the deck, to provide a working platform: battening was run fore and aft,

1 Upright at last: sitting in cradles that will be used to support the production boats' hull mouldings, the plug has been turned over so work can start on the deck and coachroof.



2 The coachroof sections have been extended and the fore-and-aft battening for the decks is in place. Note the camber to the decks, which helps increase headroom down below.

3 Here the plywood for the decks has been screwed down so there's now a working platform. The battening along the gunwale at the forward end is only temporary.

4 The coachroof sections have been cut to shape and the fore-and-aft battening is being added, plus some MDF and solid timber at the forward end of the coachroof.

5 Two layers of 5mm plywood cover the coachroof. The sides are in place and now strips about 5in (127mm) wide go over the top, glued and stapled in place.

6 As the second layer goes on, it's glued and stapled to the one underneath before being held in place along the edge of the coachroof by screws and lengths of battening.

Five coats of wax make the plug smooth and shiny. Note the wedges around the gunwale, which hold the overlap flange at 2° away from the vertical to allow release from the mould

and plywood was glued and (temporarily) screwed in place. Having a secure deck to work from, the team trimmed the coachroof sections to their final shape before the fore-and-aft battening was added to complete the framework.

Because of the relatively tight curvature at the edges and forward end of the coachroof, two layers of thin 5mm plywood in strips about 130mm wide were used to form the skin. They were held in place by staples until the glue had set. Staples wouldn't be strong enough to counter the plywood's springiness along the outer edges, so here short lengths of battening timber were screwed through into the battens underneath. A section of solid timber was shaped to form the forward edge between the front of the coachroof and the flat plinth for the forehatch.

Critical curves

Curves are important in a deck not just for comfort and appearance but also for strength, especially at the intersection of the side decks and coachroof.

This is one of the most highly-stressed areas of the superstructure when conditions become so rough that, in the words of the designer, David Thomas, 'the waves start hitting your boat instead of the boat hitting the waves.' He had experience of this on a Sigma 33 – one of his earlier designs – following the 1979 Fastnet race: hairline cracks were the only sign of stress, whereas some other boats didn't escape so lightly.

The Crabber's anchor well called for a lot of calculation, as did the stemhead, the Samson post, the positioning of the anchor roller and the bowsprit's hinging mechanism. There's a lot to fit into a small space at the bow.

Along each side deck is the toerail, with gaps for scuppers and, amidships, for spring cleats. Plinths for the winches and deck hardware and upstands for the handrails are also needed. Every detail has to be decided at this stage because the shape of the plug will be precisely reflected in the final mouldings.

7 Once the glue has set and the screws and staples have been removed, it's time to start fairing the coachroof with long-board sanders. The forward end needs particular care.

8 A substantial radius at the intersection of the decks and coachroof reduces strain on the superstructure in heavy weather. This can be one of the most highly-stressed areas of the boat.

9 The bow is always complex, especially on a boat like this with an anchor well, a windlass and a hinging bowsprit. An anchor (a 9kg plough, the largest needed) is used for sizing.

10 A recess is formed in the coamings each side to accept the headsail winches. The angle of the sheet lead and position of the cleats also have to be carefully considered.

11 Having been given a coat of grey paint, then filled and faired, the plug is painted with five more coats – each a different colour. Note the detailing around the stem.

12 After being flatted down with progressively finer grades of abrasive paper, the plug is polished with a rotary polisher and finishing compound to ensure a smooth surface.

Two of the most complex areas to build are the cockpit and companionway, but here Crabbers were able to save themselves some time. One good thing about cockpits from a boatbuilding perspective is that many of the dimensions remain constant even when the size of boat varies. Cockpits tend to be shaped around the human form, so the width of seat and height and angle of coaming that works with a 22-footer will often work just as well with a 26-footer.

By using the cockpit from the Crabber 22 as a starting point, Crabbers reduced the tooling time by around four weeks. They took a cockpit moulding, lowered the sole (because the 26's greater freeboard made it possible and it would be more comfortable) and fitted it into the plug. Then they lengthened it to around 2.13m (7ft), creating seating for six people, re-shaped and widened the coamings to accommodate the coachroof winches, and added a locker at the forward end.

The companionway is also based on an existing moulding – this time from the Mystery 30 (formerly the Link). By happy coincidence, it's just the right height to sit on top of the step formed by the locker at the forward end of the cockpit.

One-stop shop

Crabber's decision to do all the tooling themselves instead of contracting it to a third party lets them see an area – in this case the cockpit – evolving in three-dimensional form and to make decisions on features such as the forward locker and the shape of the coamings as they go. If the plug were built elsewhere, all these details would have had to be decided on paper at an earlier stage and could not then be changed.

Another benefit of an in-house team is that the mould-maker can discuss potentially hard-to-mould areas with the laminators, who can say whether a particular shape will be possible for them to lay up.

Once all the detailing has been completed, it's time to coat the whole structure in grey paint. This creates a uniform finish that shows up any imperfections in the surface. Then, as with the hull plug, comes the filling, fairing, and application of more coats of paint – each a contrasting colour, so that as the surface is flatted down afterwards the emergence of a different layer indicates how much has been removed and, therefore, how much is still left before bare wood appears.

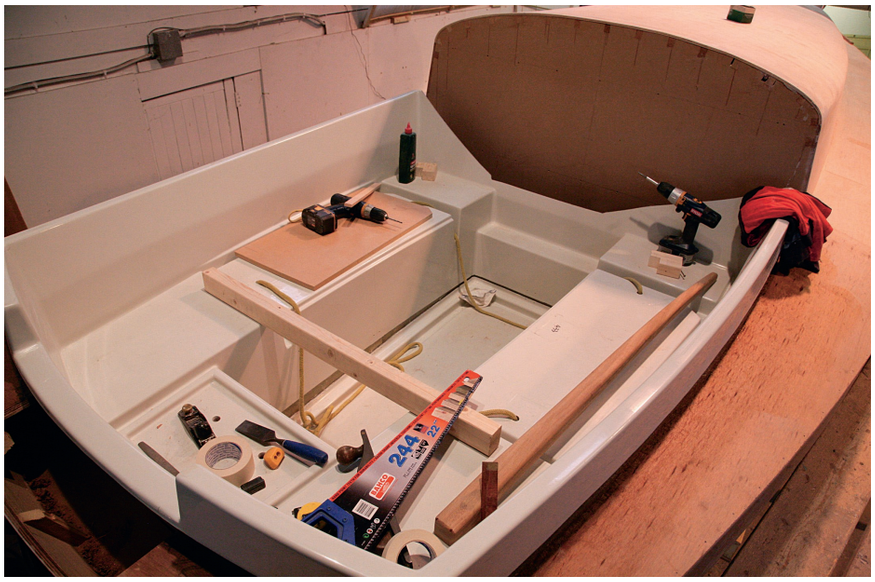
Waxing comes next and, with a hull, that would be that – but with a deck there's the non-slip finish. Crabbers use a technique they have employed many times before: sprinkling sand on to wet resin, then coating it with two coats of pigmented resin so the non-slip areas show up.

First, the areas to be treated are edged by masking tape. Radiuses are formed by a suitable curve, such as a coffee cup or the end of a plastic tube, and the tape is cut around them. The rest of the deck and cockpit is protected by brown paper before the non-slip areas are coated with clear resin. While the resin is still wet, sand (a bucket-full from the local beach) is sprinkled over it. Sophisticated equipment is called for here: a coffee tin with holes drilled in the bottom.

Two coats of resin are applied over the top of the sand – enough to ensure that it still provides adequate grip without being too harsh on clothing or skin.

Below the gunwale, the angle of the overlap where the flange of the deck fits over the hull in 'biscuit tin' style is important, because it needs to be angled outwards at 2° from the vertical to ensure release from the mould. Wedges inserted between the flange and the topsides maintain the critical angle.

Creating the cockpit



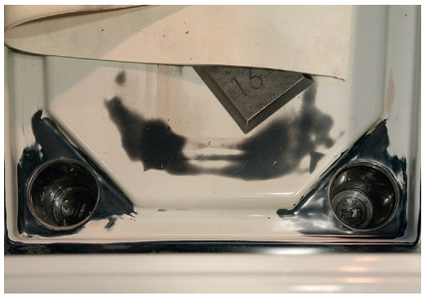
The cockpit is based on the Crabber 22's. A moulding has been fitted into the plug, and its sole lowered and angled to drain aft instead of forward. Note how it stops short of the bulkhead

Creating non-slip areas on the deck and coachroof

1 Areas to be given a non-slip finish are masked off and cleaned, and the rest of the deck is protected with paper. The non-slip extends right to the edge of the coachroof.

2 Clear resin is now rolled on to the areas to be treated with non-slip…

3 …and sand from the local beach is sprinkled over the wet resin.



High-tech solutions: the apertures for the cockpit drains are formed around a couple of plastic half-pint glasses. The drain tubes will be lengths of sabre tube, which don't need seacocks

A half-depth locker has been built in the cockpit. The sides and bottom can be cut away to create a full-depth locker, or left intact for an alternative below-decks layout with a quarter berth

Three weeks later the cockpit has been lengthened and a locker built into the forward end. The coamings have also been made higher and wider. The companionway is from the Mystery 30

Above the horizontal lip on the gunwale flange is a steel band running right around the plug. When the mould has been laid up, the edges will be trimmed around the flange and the band will act as a cutting point. The band will then be transferred to the mould, so the mouldings can be trimmed in similar fashion without risk of damage to the mould itself.

4 When the resin beneath the sand has hardened, two coats of pigmented resin are applied on top so the non-slip areas stand out...

5 ...then the masking tape and brown paper are removed to reveal the finished plug

Mould-release plate fixings

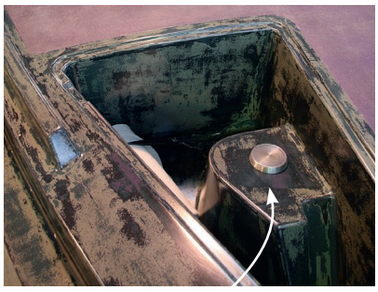
After a moulding has been laid up in the mould, it needs to be lifted out. Even though moulds are coated with release wax, a lot of pressure is needed to force the moulding out of it, and this is where release plates come in.

These metal plates are set into the mould before lamination begins and are wound up by screw threads. Four were used in the hull but the extra complexity of the deck mould calls for a good many more.

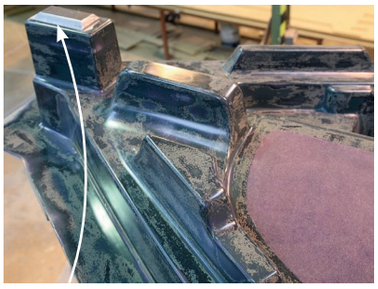
They have to be positioned on the plug before the mould is laid up so they form a recess in the mould. Each plate has a number engraved in its top that will show up in the mould, so it can be fitted into the right slot.

Locations are chosen where the faint marks that they leave in the moulding will be least noticeable: on lockers where the lids will be cut out, for example, or on winch plinths or under cleats.

First the plates are stuck to the plug with double-sided tape, then mould-release wax is applied around their edges. This stops gel coat seeping into gaps beneath the plates when the mould is laid up. If that were to happen, the gel coat around the plates would be damaged when the mould is lifted off the plug.



Release plates are positioned where the faint mark they leave in the moulding will be least noticeable or covered over, such as on the windlass plinth in the anchor well



FINISHING DETAIL: radiused curves need to be smooth and even and the finish perfect. Note the release plate on the top of the stemhead

NEXT TIME:
Tooling up for the ballast and interior moulding