

The birth of a new boat



The story so far...

Tooling up for the new Cornish Crabber 26 began in September 2009. First came the hull plug, which was finished in mid December. Then the hull mould was laid up over the plug and lifted off just after the Christmas break. A hull was constructed in the mould, starting in January, and remained in place while the interior plug and mould were built inside it as described in this article.

While the hull was being laid up, the deck plug was built on top of the hull plug. It was finished in the middle of April, whereupon the mould was constructed.



Definitions

PLUG: a temporary (male) structure built to resemble the final form of the finished moulding

MOULD: the structure (usually female) built over the plug in which the final mouldings are laid up. A mould can be used for the production of several hundred mouldings

MOULDING (noun): the final laminated structure

Creating the interior

David Harding watches the Cornish Crabber 26's interior plug and mould being produced and sees how the other parts of the boat are progressing

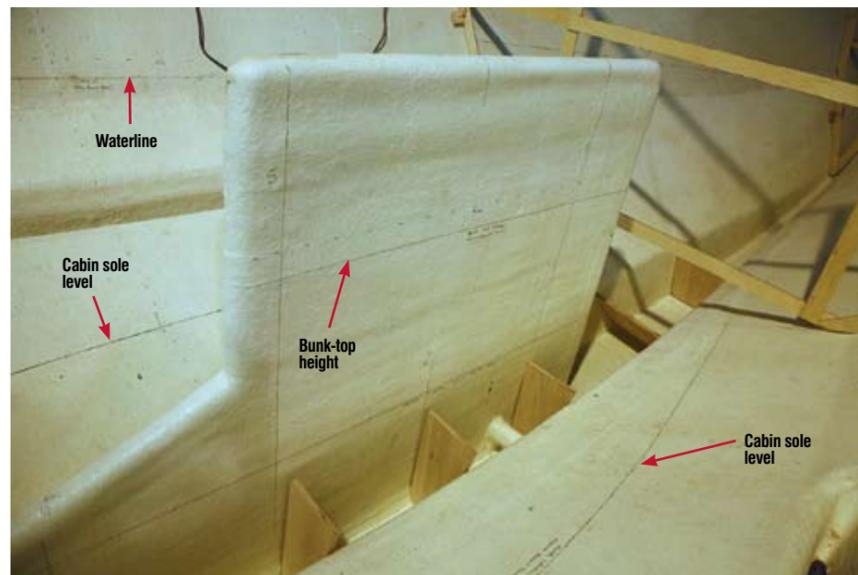
Since we started following the building of the new Cornish Crabber 26, we have seen the hull plug built, the mould taken off the plug and the first hull being laid up in the mould. In the July issue we also showed how the deck plug took shape.

Now it's time for the last of the three main moulded structures. Like many production builders, Cornish Crabbers use a moulding to form the basis of the interior: cabin sole, bunks, lockers, galley and heads. The benefit is that only a relatively small amount of timber trim is then necessary to complete the fit-out, making the building process faster.

First, however, comes the tooling and, as we have seen with the hull and deck, the process starts with the construction of a plug built from timber and MDF. In the case of the interior, the plug had to be built



With the hull still in its mould for support, the centreline is marked and 'stick templates' are made for the anchor-well and main bulkheads



The fore-and-aft 'stations', and critical levels such as bunk height, cabin sole level and the waterline, are marked on the centreplate case and inside the hull before any of the internal structure is started



Taking shape: the cabin sole is now down, with landings for the sole boards, which is why the plugs for the ballast castings had to be made first

inside the moulding of the first hull which, in turn, was still sitting inside its mould. Until a hull is stiffened by the addition of bulkheads and some of the interior structure, it's surprisingly flexible and needs to be supported.

The first job for Mark Hemmings, the foreman in charge, was to measure and mark the stations (fore-and-aft reference points on the designer's drawings) inside the hull, together with the waterline and the height of the bunk tops. Without

reference markers he would have no way of knowing what had to go where.

Then he constructed a 'stick template' for the main bulkhead out of 2in (5cm) wide lengths of 5mm plywood. It's much easier to make a template this way than out of solid ply. The 'stick template' was used to cut out the bulkhead itself. In the meantime it was positioned inside the hull as a reference point for the forward end of the ballast, because the ballast was the first major interior job to be tackled.

Ballast plugs

Other boats in Crabbers' range have ballast in the form of iron punchings (loose 'discs'), which can be poured into the bilge and then glassed in, but it was decided that solid castings in lead would be used for the 26: lead is denser, so the ballast is concentrated lower down in the hull for greater stability. It takes up less space and doesn't suffer from corrosion. Being in the form of three large blocks, however, the castings will have to be positioned in the keel before the interior moulding goes into



The solid plywood main bulkhead, with the door aperture cut out, is lifted into position



To ensure an accurate fit, plugs for the ballast castings are made inside the keel from thin plywood sheathed inside and out with glassfibre



The plugs are made into fully enclosed boxes and smoothed and sanded, ready to be painted and delivered to the foundry

the hull and covers them. That means that Crabbers had to make the tooling for the ballast before starting on the plug for the interior moulding.

Tooling up for the ballast castings meant making plugs, in the same way that plugs are made for the hull, deck and interior. The plugs would then be delivered just down the road to the foundry of Irons Bros., one of Europe's leading producers of keels. Irons would make moulds from the plugs to produce the finished castings. As these involve molten lead at over 300°C, it's a job for the specialists.

A plug for the ballast

The best way to ensure accurate sizing for the ballast plugs was to build them in situ, so Mark made them inside the keel from thin plywood which he then sheathed inside and out with glassfibre mat and resin. It was important to leave some space all round, between the plugs and the inside of the hull moulding, to allow for variations in the laminate of the production boats. When the castings are eventually lowered into the keel, any space around them will be taken up with the bonding resin.

Plugs were made for the three ballast castings: one each side of the centreplate case and one further forward.



More bulkheads and the major structures of the interior come next, fitted to the lines marked inside the hull at the outset. Here the designer, David Thomas (right), and the interior plug-maker, Richard Dickson, look at the engine bed and the alignment of the prop shaft. Note the cooker in position in the galley



Three important pieces of equipment – the cooker, engine and heads – are positioned for checking. The interior moulding stops at the aft bulkhead

Interior plug

Building the plug for the interior moulding basically means building an interior, but once the mould has been taken off it the plug is removed and destroyed.

Although many details of the interior were determined in advance, such as the height of the cabin sole above the ballast (to ensure headroom of over 1.83m/6ft), some aspects of the interior were modified during construction of the plug. For



Life at the sharp end: the forecabin takes shape, its design having been modified to allow the heads to be mounted between the berths

example, originally there was just one layout, with the heads compartment aft to port, but Crabbers' French dealer had prospective customers asking about a chart table and quarter berth in place of the heads. As a result, the forecabin was modified to incorporate provision for a toilet in the space between the berths.

Important points to consider at this stage included making provision for ducting for a cabin heater to be run through the internal moulding, as well as where the skin fittings were going, accommodating wiring runs, and the exact siting of the batteries and the fuel, and holding tanks. An engine was lowered into position so the engine beds could be made, the angle of the prop-shaft checked and the need for an exhaust-riser established. The cooker and toilet were also dropped into



Here the mould has been laid up over the plug. Release plates are fitted and the metal framework is ready to receive the rest of its wheels



Filled, faired and painted, the plug is nearly complete. A non-slip finish is being applied to angled sections of the cabin sole at the forward end of the saloon and aft by the galley and in the heads



Moulds within moulds: the interior mould is lifted out of the hull, revealing the plug which can now be broken up and removed

position for an accurate fitting.

Despite the complexity of the interior moulding, less time needed to be spent on ensuring a perfect finish than with the hull and deck plugs because of fewer large, plain surfaces and more trim and fittings to distract the eye. Nonetheless, accuracy was vital and once the form was constructed, the finishing process involved the same painting, filling, fairing and waxing.

As with the other plugs, upright surfaces were made slightly off-vertical (with a 2° angle) to ensure that the moulding would release from the mould.

Interior and deck moulds

Once the plug was finished, the mould was laid up over the top in the same way that the mould was laid up over the hull plug: gel coat was applied, followed by layers of mat and resin to create a rigid structure. Release plates (described in Part 4, PBO July) were incorporated to make sure the moulding could be released from the mould when the time comes. Then it was a matter of stiffening the mould structure and adding wheels so that once turned over it could be moved around.

While the interior plug was being built, the mould was also being laid up over the deck plug. Upon its completion, Crabbers had all three primary moulds. The deck and interior, unlike the hull, were black. This is because a mould needs to be of a colour that contrasts with the mouldings, so the laminators can see where they have



When a mould – here the interior – is released from a plug, some repair and finishing work is always needed prior to the final wax



The deck mould laid up over the deck plug, ready for the metalwork and wheels to be added before it's lifted off and turned over...



...and here it is being waxed and prepared for the laying up of the first deck. Deck moulds are often black, to contrast with the pale gel coat that will be laid up over them



Released at last: the hull is lifted clear of the mould and its lines can be admired for the first time. Note the curved bilge stubs. A rubbing strake will sit immediately above the top chine

applied the gel coat. Hulls can be light or dark but are rarely lilac, so that was chosen for the hull mould. Since deck and interior mouldings tend to be pale in colour, black is the best colour for their moulds.

Releasing the first hull

During the building of the ballast plugs, interior plug and interior mould, the first hull had been sitting inside its mould. At last, after more than three months and with the interior mould released, it was time to release the hull. First the interior plug had to be broken up and thrown out. Then it was a matter of seeing whether the hull was inclined to part from the mould. After such a long time the two structures took some separating, but Crabbers eventually managed it by winding the release plates fully down, lifting the hull with a hoist and running water from a hose pipe between it and the mould. Perhaps it's appropriate that the first hull should have had a water-birth.

Weight and plate

This was the first opportunity to weigh the hull moulding. With the rubbing strake, bulkheads and bonding material it came out at 560kg (1,234lb) – slightly overweight but within the tolerance allowed.

While the hull was suspended from the hoist, an MDF template of the centreplate was put into the case and the pivot bolt inserted. It was important to check that the plate fitted in both its raised and lowered positions before making it in steel.

The next job was to lower the hull into its 'ballast dolly'. This is a supporting structure, its shape taken from the hull plug, in which the moulded hulls will sit while the ballast, bulkheads and interior moulding are fitted.



Bits of the interior plug still remain in the hull, principally around the centreplate case. The lifting points are bonded temporarily to the inside



Before the centreplate is machined in mild steel, a template is made in MDF to ensure it fits the case in both raised and lowered positions



The 'ballast dolly', its shape taken from the hull plug, will support the hull while the ballast, bulkheads and interior moulding are fitted

