Frank Russell Goth XP build

For many years I have always longed to build my own IOM yacht from scratch, I have built “planked” wooden yachts before but this time I wanted to try moulding my own fibreglass yacht. In searching for plans I was taken by the lines of the Goth XP and previous reviews by other builders had shown this was indeed a competitive design, so a request was sent to Frank and the plans arrived in less than 24 hours!

I opted to make the hull using the “male” plug technique, forming the finished hull over a plug rather than making a traditional two piece mould. I understood that the finish on the outside of the hull wouldn’t be as good as one produced in a “female” mould due to the lack of gel coat, but the effort in producing a “female” mould for two hulls really didn’t seem worth the effort (and expense!). It was my plan to build two boats, just in case things went wrong, and yes, I DID purchase two copies of the plan!

The Hull plug

The plug was made using the traditional method of shadows and planks. I used balsa as the main planking material, but used spruce on the gunwales and chines so that the edge definition was a bit more defined and durable. I am not going to go into great detail on the manufacture of the plug as there is already a great deal on information on the internet.

After the initial sanding I used card profile templates from the plan to achieve the final shape. It's worth really taking your time here as the finished hull shape will only be as good as the shape of the plug and symmetry is absolutely vital!

The finished sanded plug was then covered in one layer of 100g Woven Glass Twill and allowed to dry before a final coat of epoxy laminating resin mixed with micro balloons. This both seals the wooden plug and gives a good base for final sanding to a smooth even surface. A couple of spray coats of a good primer / filler before finishing with 1500 grit Wet 'n Dry left the plug looking pretty good!

Moulding the hull

The hull was coated in several layers of chemical release agent (this releases far cleaner than PVA based releasing agents in my opinion) and formed using 3 layers of woven fibreglass cloth, one layer of 100g Woven Glass Twill and two layers of 160g Twill, all bonded with epoxy laminating resin. Take care to ensure that all layers are well "wetted out" as well as smoothed out evenly over the surface of the plug. I found that using a short pile roller gave a much better result than with a traditional brush. Whilst still wet, a thin weave Peel Ply was smoothed over the surface to ensure the final surface was as even as possible and any excess resin was soaked up

The final lay up was left for 24 hours before trimming the hull to the finished shape whilst still on the plug.

As my plug was made from balsa it wasn't going to be stiff enough to use the vacuum bag technique, which would have helped removing even more excess resin, but all other Hull components were formed using the vacuum method.

Rear deck

I decided I was going to make the whole rear deck in one piece rather than a series of individual parts. Rather ambitious but nothing venture, nothing gained.

This time I made the plug so that the surface of the plug was going to be the "good" side of the moulding. The Deck Well and radio pot recess were made from balsa and coated in epoxy resin and fine woven cloth, sanded and painted the same way as the hull plug. Both parts were then mounted to a flat piece of 1.5mm plastic card, along with another piece of raised plastic card for the rear hatch recess. Sharp internal corners were filleted using moulding wax before the whole assembly was given several coats of chemical release agent.

As this plug assembly was far stiffer than the hull I decided I was going to "vacuum bag" it. An initial coat of home made gel coat was applied (colloidal silica and epoxy laminating resin) and allowed it to become tacky before the lay up with 3 layers of 100g woven glass cloth were applied, with extra layers for stiffness added to the bulkhead where the Mast Ram will pass through. Whilst still wet, the whole thing was placed inside a vacuum bag, sealed and a vacuum applied via a car brake bleeding hand pump. Once any leaks in the bag joint had been sealed the whole thing was left for 24 hours to cure.

Vacuum bagging of the Rear Deck

Releasing the mould was not for the faint hearted and took a great deal of time plus the application of brute force in some areas. However, the result was well worth the effort as after one final pull the whole thing released to reveal a near perfect moulding – very pleased for my first attempt!

Rear Deck mouldings fresh from the plug!

Foredeck

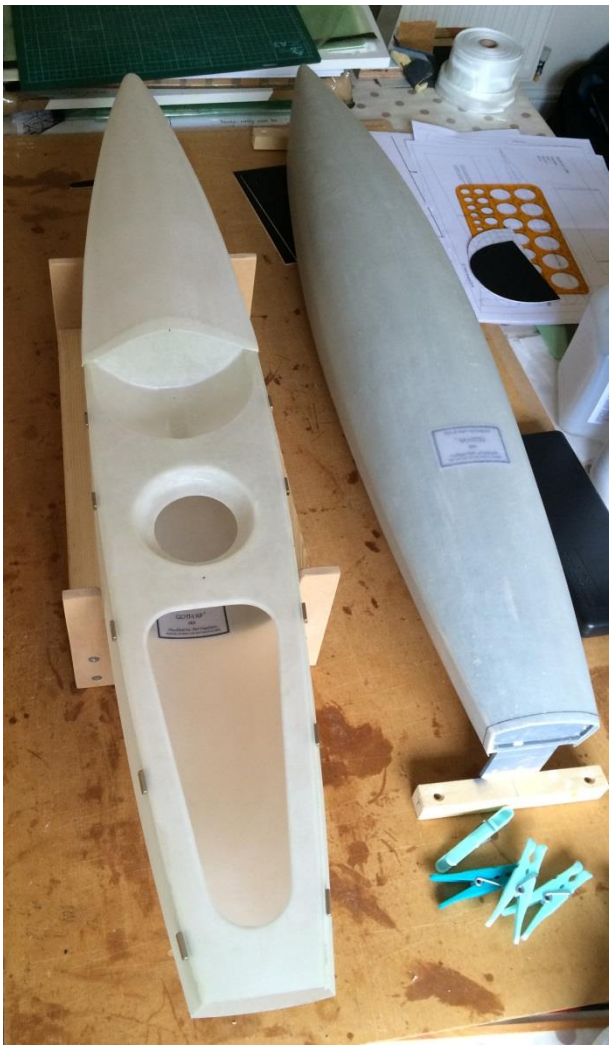
A plug was made using the same technique as the hull only this time I used thicker balsa planks to ensure it was stiff enough to take the vacuum. As the moulding is a relatively simple shape the finished moulding more or less fell off the plug.

Finishing the mouldings

To ensure the surface finish of the hull and foredeck was suitable for final painting I smoothed over a very thin layer of fine surface car scratch filler, left to dry, and then cut back with 1000 grit wet ‘n dry. All this stage was doing was filling in the tiny pin holes that are left after moulding so the weight it added was negligible. The rear deck, as it had a gel coat surface, was more or less ready to use as it was, with just a few small areas that needed filling with a epoxy / micro balloon mix and then sanded back.

Hull, Rear Deck and Foredeck before trimming

(Rear Deck plug shown on right of picture, note the raised edge of the mould so that a flange can be created to epoxy it into the hull)



Finished mouldings

(LH hull shows magnets used to hold the rear deck flange in place whilst epoxy sets)
(RH Hull on plug ready for fine surface filling and sanding)

Fin

Most people advised me not to attempt to make a fin but to purchase one. However, I was determined to make as much of the boat as I could, so I ignored their advice!

Not having easy access to a CNC milling machine to make the mould I went down the conventional route of making the plug in two halves from 4mm plywood and then sanded to shape. Reference holes were drilled in both halves to make sure they aligned when the mould was together. The two halves of the fin plug were glued to separate pieces of flat plastic card and the card glued to rigid MDF back boards. The surface of the plug was filled, sanded and painted to achieve the best finish possible. It was my goal to have the surface of the fin showing the weave of the carbon fibre weave, but it didn't quite work out that way.

The two halves of the plug were polished, given a coat of release agent and then a good coat of epoxy gelcoat. Once tacky the first few layers of glass fibre cloth were applied, starting with the finest weight of 100g before slowly building up the thicknesses until a final mould thickness of around 4-5mm was achieved. This took several sessions as it is not practical to achieve in one go.

Once the resin had fully cured, around 72 hours, the plugs were released and final two halves of the mould polished to a mirror finish.

Finished Fin mould

(Note the cut outs top and bottom for supporting the brass threaded inserts for holding the bulb and fin nut in place when the two halves are bolted together)

Now the interesting bit, what to make the fin core out of? I had read about several materials that could be used, balsa, honeycomb, foam etc. After a bit of research I opted for two test pieces, Depron and EasyCell 75 Closed Cell PVC Foam. The foam was cut to be about 1mm smaller all around to the finished fin shape and then sanded to the correct aerofoil profile of the mould.

The fin needs have several properties, staright, stiff (lateral and torsional), light and smooth. I opted to use 90g ProFinish Carbon Fibre Plain Weave with three layers per side covering the core. The mould was laid up with three layers of carbon per side and the core sandwiched in between before the two halves of the mould were bolted together tightly to induce pressure to whole assembly.

After 24 hours of curing the two halves of the mould were separated and the finished fin removed. On first inspection the surface of the fin was excellent, but after close inspection there were numerous tiny pin holes on the surface. Therefore the fine surface filler came out again and the whole fin was filled, sanded and then finally spray painted.

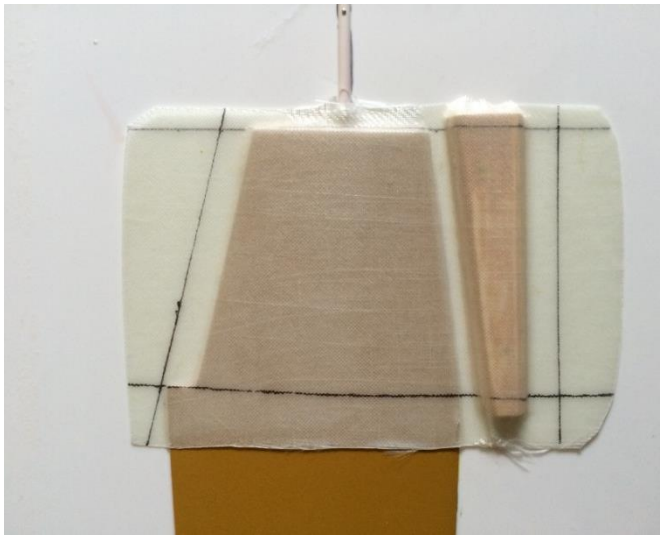
Finished Fin (114.4 grams)

The finished fin was exceptionally stiff and light (114 grams). I'm not sure how it compares to a commercially available fin, but it looked pretty close to me!

There was little difference in stiffness between the two core materials, but the Depron core was around 10g lighter.

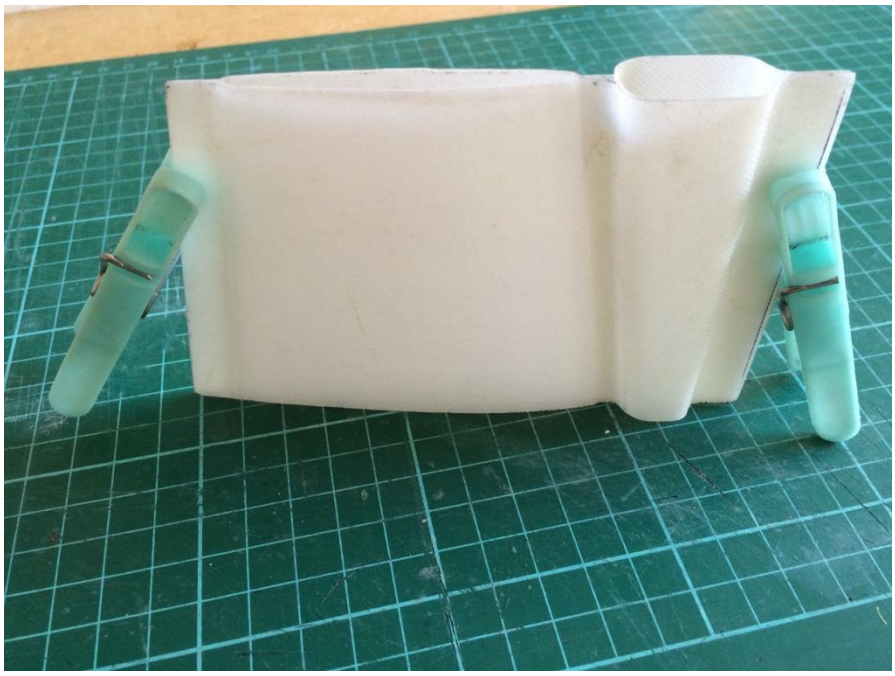
Fin Box

The plug for the fin mould was used and in addition a "male" of the mast tube was added. Three layers of 160g woven fibreglass applied and again vacuum bagged until fully cured.



Fin Box and Mast tube half moulding on the plug

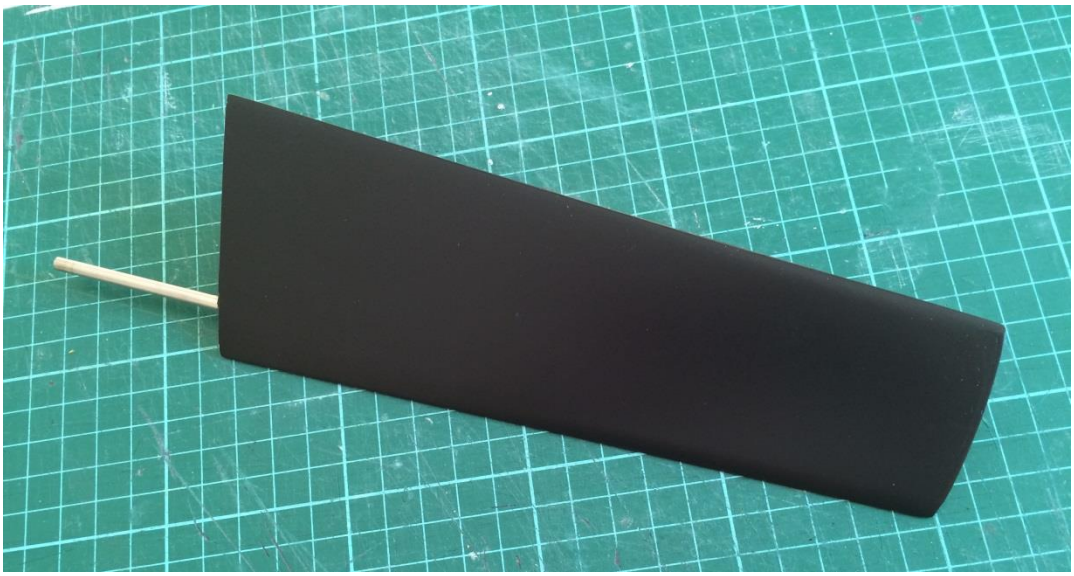
Trim lines showing sufficient flange for epoxying two halves together



Finished Fin Box and Mast Tube

Rudder

The rudder was made in exactly the same way as the fin, only this time only two layers of carbon per surface were used and a 4mm stainless steel rudder stock inserted prior to joining the two halves together.



Finished Rudder

Bow Bumper

A balsa wood plug was sanded to the required shape before filling, sanding and painting. The plug was mounted to a flat piece of plastic card and a box made to surround the plug, also from plastic card. A very thin layer of Vaselene was applied to the surface and a mix of Plaster of Paris poured into the box to cover the bumper plug.

Once set, the plug was released and the plaster mould was coated in another thin layer of Vaselene to act as a release agent.

The bumper itself was made by pouring Room Temperature Vulcanising (RTV) silicone into the mould and left to set for 72 hours.

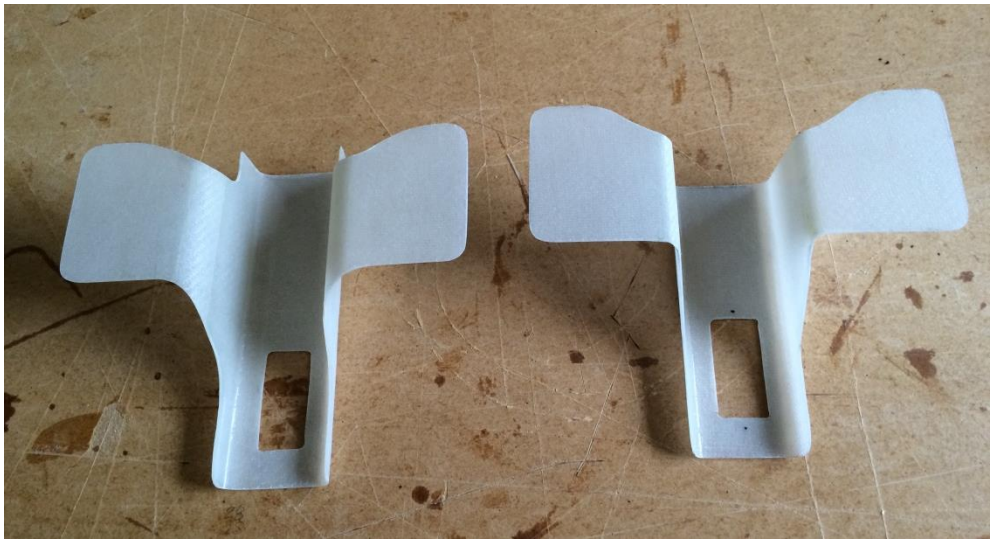
The finished Bow Bumper was given a final trim to remove the excess “flash” from around the edges. It will be stuck to the finished Hull by again using RTV silicone.

Bow Bumper

Plaster mould (Top), Plug (Middle), finished Bumper (Bottom)

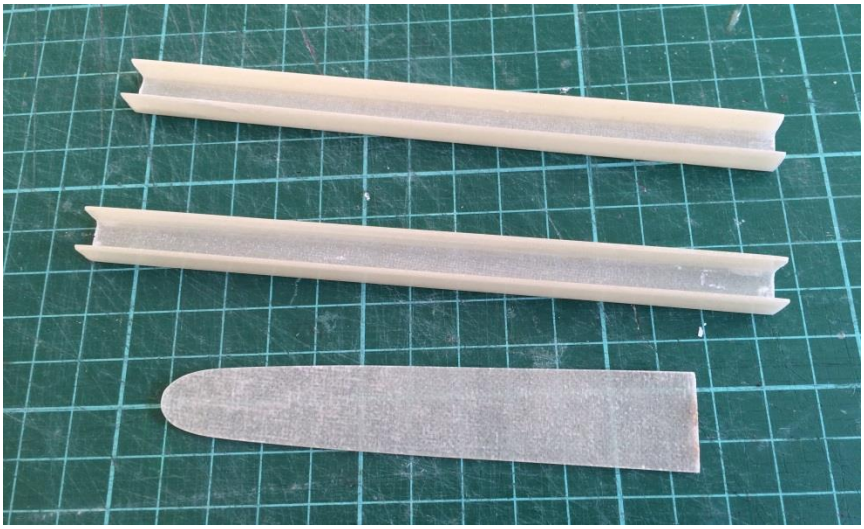
Rudder servo tray

A simple plug was used to make the Rudder Servo Tray and the moulding trimmed to give the final shape.



Rudder Servo mounts

(The one on the left is slightly longer to help support the Main Sheeting post. The tray is epoxied to the underside of the Rear Deck)



Shroud point support beams and Bow piece

Winch Tray

As I was using an RMG winch I opted to make a sliding tray arrangement that could be accessed via an opening in the Foredeck.

Winch Tray support and mount

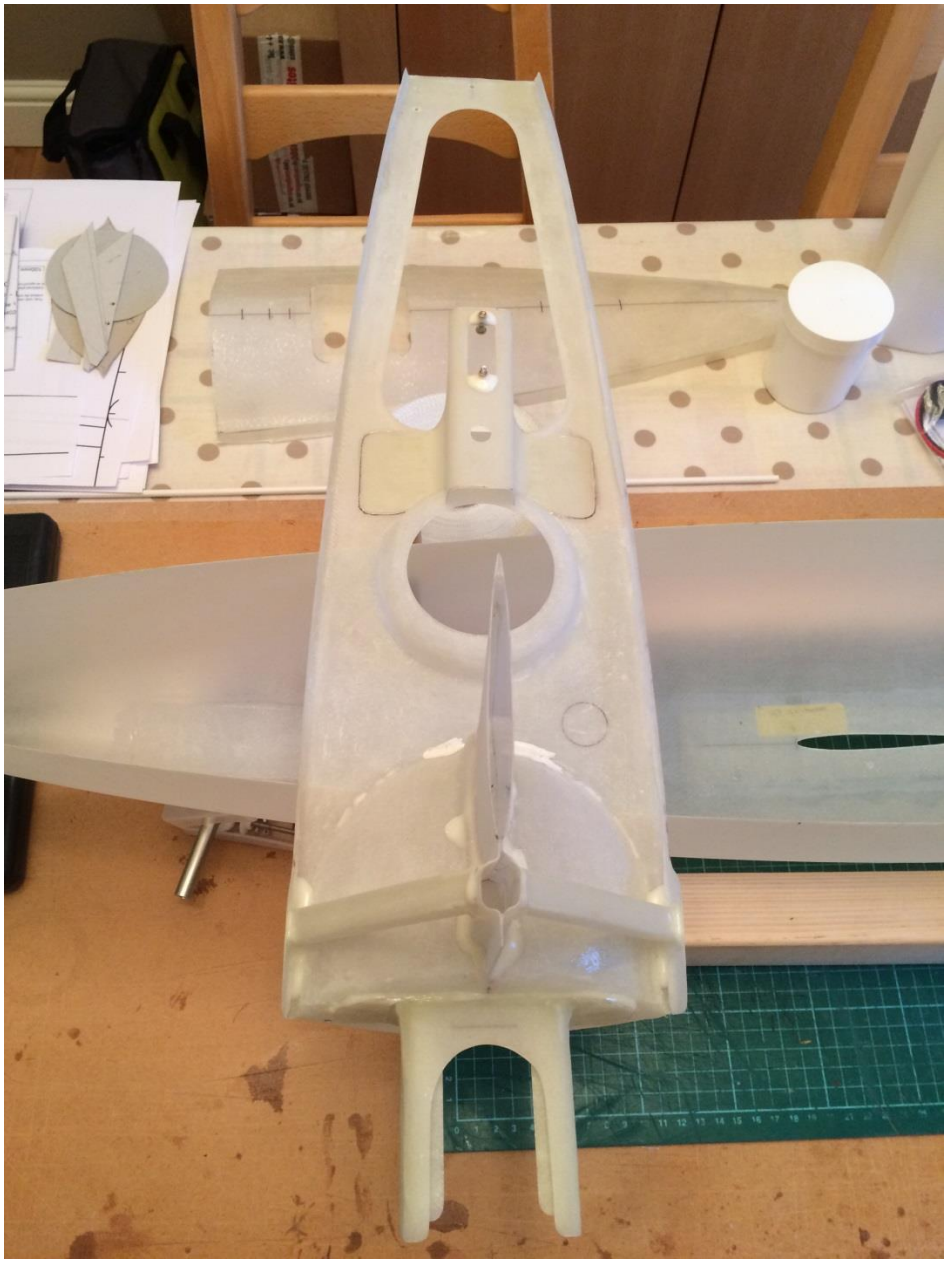
The finished tray support is epoxied to the rear of the main bulkhead prior to gluing the Foredeck in place

Final assembly

The key word here is **ALIGNMENT**. To make sure that all components were exactly in line I used a laser level to check, check and check again before applying any epoxy!

The Fin Box and strengthening diagonal beams for the shroud mounting points were epoxied together BEFORE fitting the rear deck. The assembly sequence was as follows:-

1. Fit transom, bow piece and rudder tube support brace to the Hull.
2. Fit the Fin Box, beams, Winch Tray and Rudder Servo Tray to the underside of the rear Deck.
3. Fit the rear Deck assembly to the Hull using strong magnets to hold in position.
4. Drill and fit Jib swivel points and sheeting eyes to the Foredeck as well as cutting out the winch access hatch.
5. Fit wooden inwhales to the inside of the Hull for the Foredeck to glue onto.
6. Finally, fit the Foredeck and join with epoxy / micro balloons mix by the use of a syringe and flexible tube to ensure a water tight bond.



Underside of Rear Deck showing Fin Box, support beams, Winch Tray and Rudder Servo Mount

Final Assembly with all major components in place

Inside view showing Jib Pivot support piece under the Foredeck and wooden inwhales.

(Not the neatest of epoxy applications when using a syringe and tubing inside the boat!)

Final assembly prior to painting

High Build Primer stage

After final painting

Winch installation

Mid section

Rigged and ready to go (Minus deck patches and radio pot of course!)

Finished set up

Final touches

Now the fun bit!

With Spektrum radio gear, RMG winch, 1000 mAh LiFe battery installed. Rigs (supplied by CM Yachts, UK), sails by Catsails (superb quality!) it was time for the final weigh-in. The total came to 3750g. OK, not the lightest IOM in the world but at least it was on the right side of 4kg!

With the correct ballast weights added it was time for the maiden voyage.

An initial error with the sheeting arrangement (my mistake!) caused a slight delay but it was soon resolved. The first outing was A Rig weather, but enough breeze to make it interesting. The rig was set up pretty neutrally with everything at its “mid-point”. After tweaking the mast rake by a couple of millimetres the boat tracked beautifully, pointed well and could be sailed more or less hands free from the start. I can honestly say I have never sailed such a well balanced boat! She turns on a sixpence, accelerates well and has a good turn of speed when beating. There was only a very slight bit of nose diving when running down wind, but that was more due to the gusty conditions rather than the design I’m sure.

A few weeks on and the boat has notched up a couple of victories at our local club (Lincoln Model Yacht Club, UK – home of the 2015 UK Nationals) against some pretty stiff competition and it has even claimed a couple of Britpop! scalps.

So to summarise, a fantastic design (thank you Frank), a very enjoyable build project and my first fully homemade fibreglass IOM yacht is complete. Will I be building another? Well, I have to finish off hull number two for my son and then I think it’s time to concentrate on tactics and getting more wins under my belt. But I am proud to say to other skippers when they ask me where I got it from “This boat is built, not bought!”

Phil Harpham June 2015