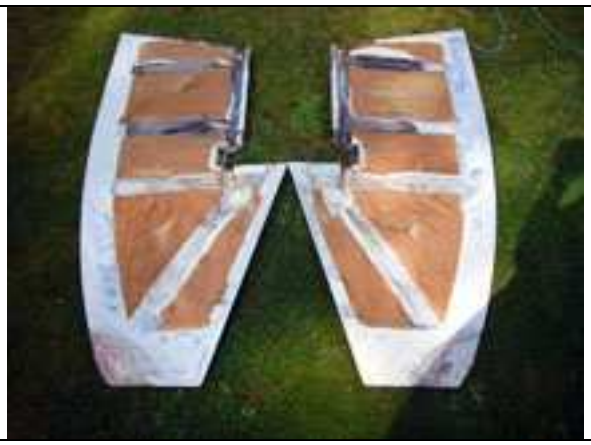
Split rudder repair 2009/2010

Whilst returning from the Scottish west coast to the Clyde via the Crinan canal Saorsa was blown broadside across the canal by the 30kn wind as we waited to enter the lock at the end of the top reach.

With some difficulty, I tried to turn against the wind in the confined space, but as we came astern the rudder hit the canal bank and some bits of foam appeared on the surface. I presumed that the tip of the rudder had been broken off, but steering seemed fine so we continued on our way. After descending a few locks we set off along the next reach, but had only motored a short distance when I felt a slight bump and, looking aft, saw half my rudder floating away! Luckily the wind was on the nose and neatly swung the boat round as I cut the engine revs and we drifted back to a nearby pontoon berth. The half rudder, which had split vertically, was retrieved from the canal side bushes by inflatable dinghy. Next day an obliging crew of a large racing yacht all stood on the foredeck as I drilled a hole in the top corner of the remaining half rudder and attached a rope as a precaution. We then took a tow from a passing yacht, just in case the rudder came completely to bits and we lost steerage, however we made it to the canal exit basin without a problem. The weather was still bad so we went home by car and returned a few days later on a friend's yacht to retrieve Saorsa for the thirty mile tow home. The rudder behaved perfectly until we were rounding Ardlamont Point in a bit of a chop and I realised we were towing the remainder of the rudder. It is surprising just how much directional control still exits with only the bare skeleton of the rudder! *Close inspection of the two rudder halves showed that the rudder had suffered slight damage to the lower trailing edge some time in the past and that some water penetration was evident.*



We dried out in our local harbour for inspection and, on finding no damage to the steelwork, elected to go for a lift out at our local boatyard and a temporary repair to last the season.

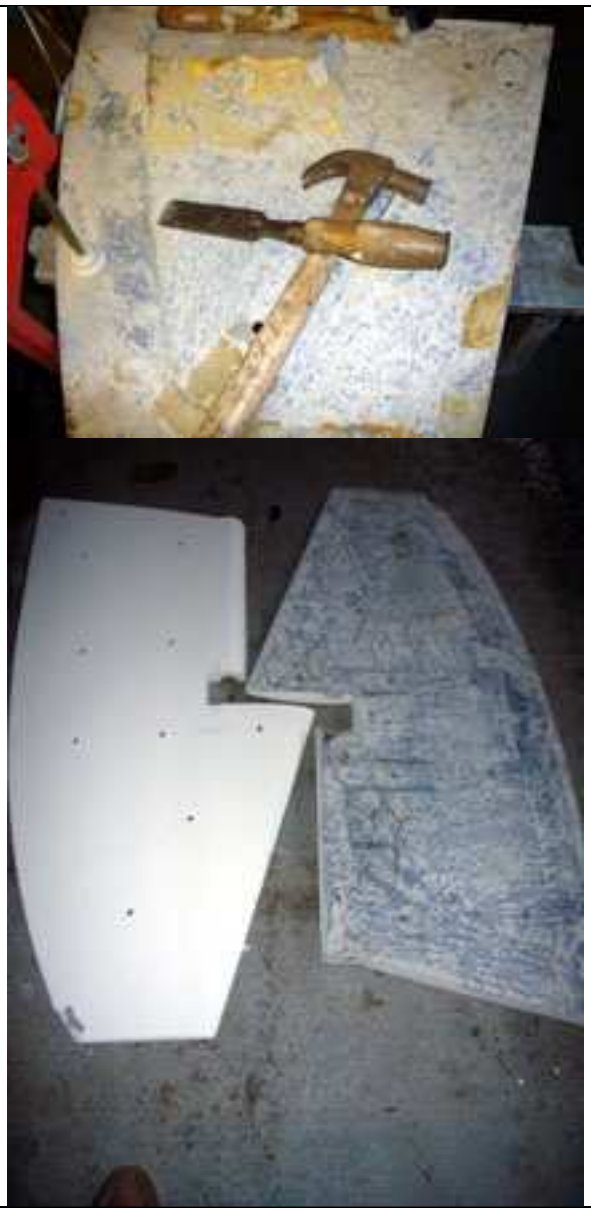
Holes were drilled through the rudder plates and equivalent ones through each of the rudder halves before assembling the rudder with bolts, washers and polyurethane glue. (P1030178/182)

On lift out at the end of the season, the rudder was removed by first unbolting the steering mechanism. At this stage I discovered that the “earthing” cable which should have been attached to the rudder stock was broken. The rivet heads on the lower rudder bearing shoe were drilled off and the rivets knocked out. The heads of the slotted screws holding the lower bearing were in a poor condition, possibly electrolysis due to the rudder having no direct connection to the sacrificial anode.

An impact screwdriver was needed to loosen these screws but the heads of two had to be drilled out. All the screw threads were in perfect condition. This posed an additional problem as it proved impossible to source replacements - the screw threads were found to be the old British Standard Whitworth and no longer available. However a length silicone bronze rod was purchased and a friend who had access to a lathe kindly machined new ones. A drill, made from a piece of steel tube,

had to be used to release the temporary bolts holding the two halves of the rudder together, before they could be removed and the rudder split, with great difficulty, using an old paint scraper and a hammer. The polyurethane glue had done a superb job and there was little evidence of water ingress. (P1030321)

The foam and binder were chipped out of both shells.



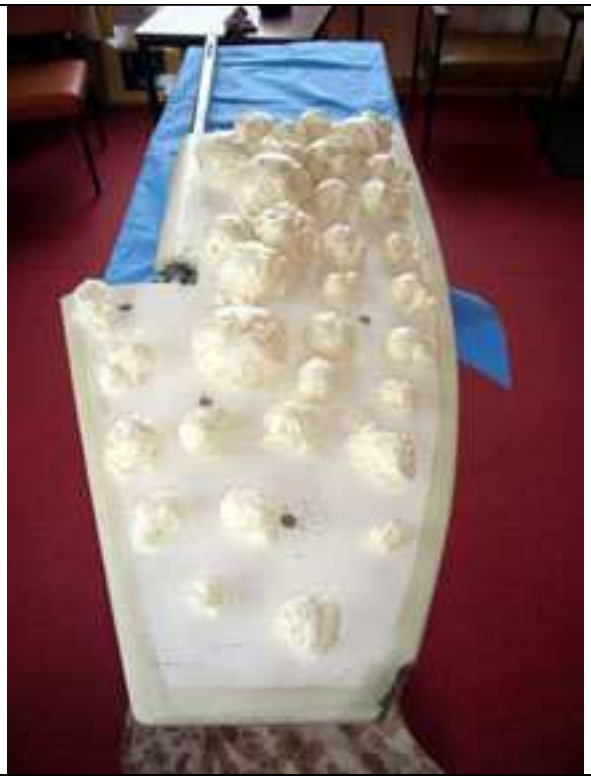
Glass fibre mat and resin was laid up in strips to thicken each shell so that the existing holes, drilled for the temporary repair, could be countersunk to receive screws in place of the bolts.

Nuts were welded onto each side of the rudder plates in line with the holes.

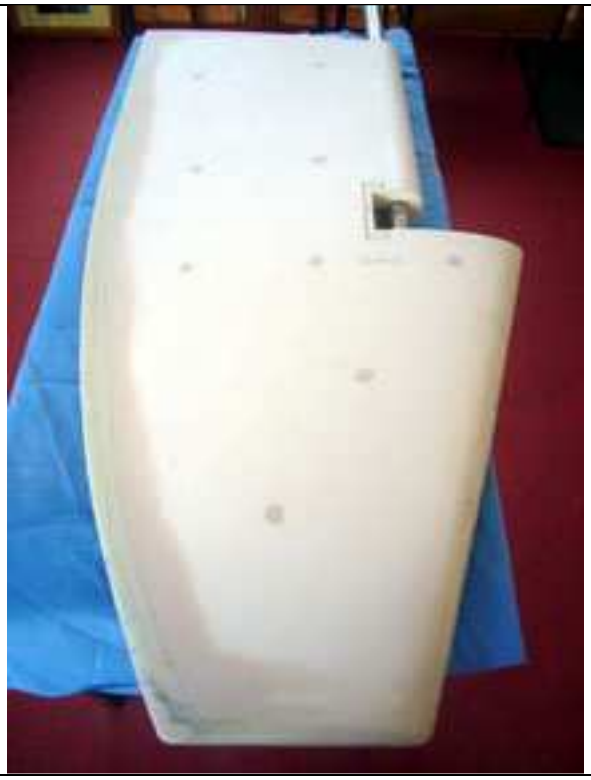
The rudder was then dry assembled to determine the correct length of screw needed for each fastening and the size pencilled beside each hole. The countersunk screws were cut to length and one half of the shell was fastened to the stock. Polyester filler paste was trowelled into the shell beneath the plates and round the rudder edges and stock.

To align the second shell whilst preventing filler from entering the nuts, wooden dowel rods were screwed into the nuts before applying filler paste and bringing the two parts together. The dowel rod was removed and replaced with countersunk screws. As the screws were tightened, filler was squeezed out and removed. G cramps were attached around the edges to hold everything in place until the filler set.

Three layers of glass tape were laid up around the edges, filled and faired. Numerous holes were then drilled into the voids and expanding foam injected in and allowed to expand and set before cutting away the excess.



The injection holes were countersunk to give an increased surface area for the final filling and fairing.



The rudder was then given four coats of epoxy paint prior to refitting.

New O ring seals were fitted to the rudder shaft main bearing and given a liberal coating of silicone grease. The rivet holes in the shoe were drilled out to accept slightly larger rivets

and countersunk accordingly. The lower bearing shoe, together with the thrust washers, was assembled onto the rudder prior to fitting to the hull and the keyway on the shaft was taped to prevent damage to the O rings. This last move, however, did not work as the tape would not stay in place whilst the shaft was inserted so the sharpness on the edges of the keyway was carefully removed. Once fitted the rudder was firmly held up in place on wooden blocks and the shoe wedged up into place whilst the skeg holes were enlarged.

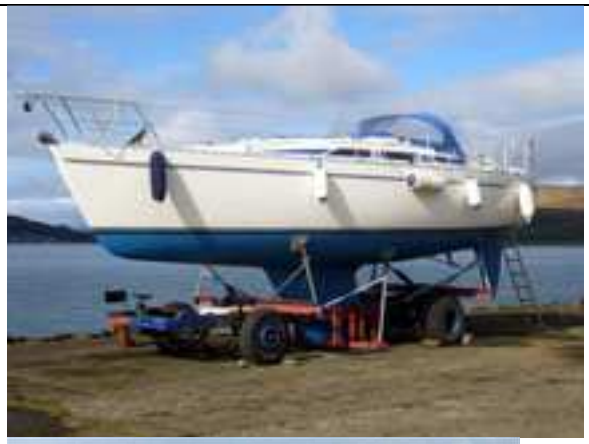
The whole assembly was then lowered slightly, to allow sealant to be applied to the inside of the shoe, before being raised once more and the new rivets inserted.

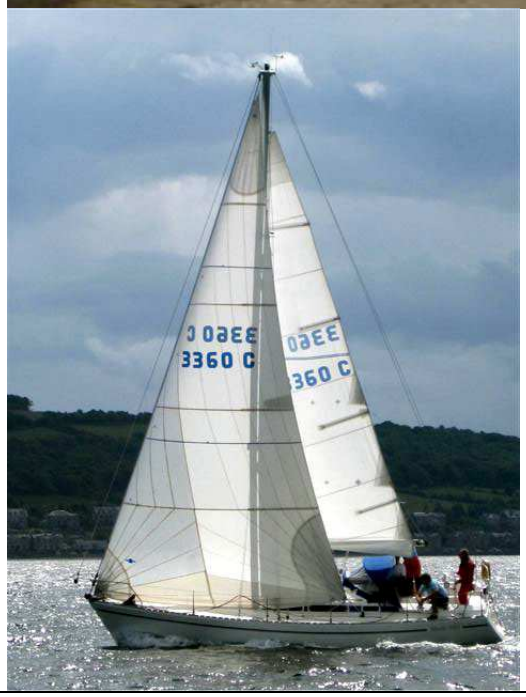
The new rivets had been cut to length, allowing a 5mm protrusion at each side, from a length of copper rod.

Once cut and numbered, the ends were annealed by heating to a dull red and quenched in water. This made forming the rivet heads an easier job. A 7lb hammer was held against one

side of each rivet in turn whilst the head was formed on the opposite side with a ball pein hammer, swopping sides a number of times until the rivet heads were properly formed.

All that then remained was to reattach the steering mechanism and antifoul, ready for the new season.





Silicone bronze and copper rod from www.metalsontheweb.co.uk

O rings and O ring grease from www.polymax.co.uk

GRP mat, tape, resin and filler from www.allscotltd.co.uk in Glasgow