

Conserving Asgard: Approach, Methodology and Processes

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Conservation or Restoration?

The terms ‘conservation’ and ‘restoration’ were both used when *Asgard*’s future was being discussed. However, both terms are often misunderstood and misused. Many believe each approach to be the same when in reality they are each entirely different. In the context of wooden vessels both terms can be used to describe the process of saving a vessel, with a broad interpretation of their actual meaning divided between those who wish to sail the vessel concerned and those who want to see it preserved indoors.

In practice, a conservation process seeks to protect and preserve as much original material as possible. Restoration can have the opposite aim and is often an open-ended approach that can result in the removal of any material, as deemed necessary to enable an object to be used again. In dealing with ships and boats, this can, and often does, result in the entire replacement of a vessel’s structure.

With *Asgard*, conservation was the chosen pathway. But in reality there were some necessary aspects of restoration, where irreversibly-damaged, structurally-important parts had to be replaced, or have had material removed in order to maintain structural integrity. The relevant factor is the approach – that of striving to preserve original structures and materials where possible.

Structure and Fastenings

Asgard is a sturdily-built yacht, very much of Colin Archer's stable. Built in Norway in 1905, she measures 15.5 metres in length from stem to transom, with a beam of 4 metres. Construction is carvel, of oak (topsides) and pine (underbody) on sawn double frames. When first built her hull planking was fixed with brass boat nails and treenails. However, over time there were re-fastenings, the most extensive in 1968, all involving galvanised steel boat nails. Furthermore, the sections of wood forming her double-frames were each butt-jointed together and fixed with iron straps fastened across each joint.

The combination of these different metals - iron, steel, zinc (the galvanising coating), brass and copper - all in close proximity to each other in wood with a high moisture content, created an interaction between the different metals in a salt-laden environment. In effect, brass, iron, steel and zinc in close proximity act as hundreds of active batteries, with the lesser metals (iron, steel and zinc) becoming the anodes to the cathodes (brass), and the seawater providing the electrolyte. The vessel was riddled with corroded iron and steel fastenings and fittings, all of which damaged surrounding wood. The large iron keel bolts were likewise affected and corroded extensively.

Analysis of a selection of steel hull fastenings by David Watkinson, Head of Conservation at Cardiff University, a noted expert on corrosion, found *"that the steel nails are highly unstable and contain significant amounts of chloride, are actively corroding and will continue to corrode in the mid-range relative humidities that suit the physical stability of wood"*. In other words, corrosion would continue in the ideal environment that is best suited for the long-term protection of *Asgard's* wooden structure.

The presence and effect of chloride in iron is a relatively recent concern where historic vessels are concerned. It is the main problem in both the UK historic ships *Cutty Sark* and *Great Britain* and the cause of extensive damage to both vessels. *Asgard* may be the first wooden vessel where its presence in hull fastenings has been identified specifically as the destructive catalyst it is.

It became clear that in order to stabilise the vessel and protect her in the long term, all iron and steel fixtures and fittings would have to be removed. To leave corroding metal in place would result over time in their total mineralisation, further destruction of surrounding wood and massive damage to structural integrity.

If we were restoring *Asgard* to sail instead of conserving her we would just pull the old planks and their fastenings off, remove the corrosion-damaged frames and renew both planking and framing. However, that would lead to the destruction and loss of her original structure and result in a virtual replica, given the extent of corrosion-damaged wood and the need to meet marine safety and insurance standards of seaworthiness. This is the fundamental difference between restoration and conservation where original structures are involved. One destroys in order to 'save', the other saves without destroying.

Approach

The approach to conserving as much of *Asgard's* original hull structure as possible was to remove the hull planking and damaged frame sections, causing minimum damage in the process; then to repair and consolidate them while retaining fundamental integrity. However, as any shipwright will agree, removing boat-nail-fixed planks from large wooden vessels usually results in the destruction of the planking.

Hull Planking

After considering several methods for removing the hull planking relatively intact, it was decided to use small engineers' hole-saw drills, which come in a variety of diameters (we use 17mm and 20mm dia.), and by lucky coincidence are of a similar length to the thickness of *Asgard's* planking. Using the planks' countersunk fastening holes as a guide, each nail was bored around to the thickness of the plank, effectively removing damaged wood immediately surrounding the nails. With all fastenings in a plank section bored, the plank could then be lifted from the nails, leaving them to be pulled separately quite easily.

The newly-created holes were then further cored out from the inner face of the plank with a cone-shaped bit specifically designed to suit the range of depth of cut required. This rid the holes of most of the degradation caused by corroded fastenings. Then wooden cross-grained cone plugs (formed to match exactly the shape of the cone bit) were glued into each hole, using a urea-formaldehyde wood adhesive. The plugs were then planed flush, giving a smooth finish to both outer and inner plank surfaces. When the planks were re-fixed in position, the areas with glued cone plugs each landed exactly on a frame, with the wider portion of the cone plug on the inside.

With badly-damaged areas of planking, localised repairs, such as scarped-on wooden inserts, were fitted, often in a variety of shapes, to suit local need and keep the removal of original material to a minimum. Where butt-ends and hood-ends of planks in particular suffered from over-fixing damage, they might be cut back and have a matching portion of new wood scarped on to form strong, well-fixed butt-ends. These repairs can be seen clearly on the vessel's starboard side, which is varnished to allow sight of the extensive nature of the conservation process used.

Framing

The frames were affected both by corroding nails and iron frame butt-straps. Corrosion damage around the butt-straps tended to be extensive, given the surface area of the straps and their fastenings. In consequence, frames required a greater replacement of material than hull planking. Fastening holes in the frames were drilled out to remove rust residue and degraded wood and were then plugged with glued wooden plugs. Butt-strap corrosion damage could be dealt with either by scraping down to sound wood or by cutting away badly-damaged wood and scarping and gluing inserts. The iron straps were replaced with brass straps, and through-fixed with copper round bar riveted over brass washers. The intention was to replace all ferrous material with silicon bronze, brass or copper fastenings and fittings.

One thing is clear – had the approach with *Asgard* been that of restoration to sail, then in certainty all planking and framing would have been lost. The extent of corrosion-induced damage was much greater than first assumed. This became obvious when separating mating surfaces and gaining full access to areas behind beam-shelves and stringers and when parting the large double floors and futtocks.

Deck Beams

The original oak deck beams (over 90% original) and kauri pine deck planking (some 80% original) also needed careful handling and treatment. The deck, which was tongue-and-grooved and iron-nail secret-fastened, had similar corrosion damage to the hull planks – localised in the vicinity of the fastenings. Likewise, the deck beams were affected by the same corroding nails and were riddled with rusting and disintegrated iron.

The approach with the deck beams was to drill out each fastening hole with a larger diameter engineers' drill bit to clear the hole of damaged wood. Each hole was then plugged with a wooden dowel (of oak) glued in place. Specific damaged areas in beams were dealt with in a similar context to the hull planks and frames. For example, a number of the beam ends had degraded, largely caused by corrosion of iron fastening into the beam shelf. As with hull plank damaged hood-ends, the damaged wood was removed and new portions scarped into place. With the beam ends, new wood was both glued and bolted into place, but using stainless steel bolts.

Deck Planking

Saving the deck planks called for a slightly less rigorous approach. The deck, being secret-fastened (i.e. diagonally through the side of the plank on each beam), coupled with the relative lightness of the planks (65mm x 38mm) and the tongue-and-grooved aspect, called for a more delicate approach. Because of the angle of each fastening hole, which also passed through the tongue side of the plank, coring out was left until the planks were being re-laid. Surface cleaning and some scarped-on plank-end repairs were first carried out. Because the deck planks had worn somewhat unevenly over their top surface over time, this was resolved by passing all the deck planks through a small planer/thicknesser to given an even thickness and clean the very soiled top side. This effectively reduced the thickness of the deck from the original 38mm to 33mm. Then the deck planks were re-laid and clamped in place, needless to say with each fastening position corresponding with a deck beam.

The old fastening holes were drilled out to a larger dimension to remove rust damage, but at the same angle as the original fastening and continuing into the beam a few millimetres. The hole was then plugged with a glued wooden dowel, which also just entered the beam. New stainless steel nail fastenings were 'secret' inserted beside the old nail positions in clear wood in both plank and beam.

During the above programme of works the entire vessel was effectively deconstructed in a co-ordinated process, to allow her structure to be analysed in the fullest sense. In effect, every mating surface was parted and examined so as to consolidate, repair and preserve wherever possible.

Replication of Missing Structures

The original accommodation, cockpit and deckhouses were removed from *Asgard*, partially in 1932, and totally in 1968 when she was converted to be Ireland's first National Sail Training vessel. A completely new layout was installed then, as was a wider deckhouse and wheelhouse. As we were returning *Asgard* to original built form, the first major task of the project was the removal of all the non-original structures, including the later deckhouse and accommodation. This effectively returned the vessel to a bare hull, with deck and deck-beams only.

Separate to the programme of conservation of the hull, the original accommodation layout, with deckhouse, cockpit, fore companionway and all attendant structures have been recreated in original form, as on Colin Archer's final general arrangement plan and as discussed in considerable detail between him and Erskine Childers.

As with the conservation process, the same species of woods were used in the re-creation of all the structure as specified in Archer's Articles of Agreement and Specification of 23rd February 1905.

Materials

WOOD

Throughout all the above works, wherever new wood was utilised the same species as that of the part being repaired was used. The various woods concerned included:

- European oak: topside planking, deck beams, bent timbers
- Douglas fir & pitch pine: underbody planking
- Iroko: replacement planking (1968 Sail Training conversion)
- Scots pine: double framing, wooden keel
- Kauri pine: deck planking
- Teak: covering boards
- Mahogany: rails

METAL

Given the damage throughout the vessel caused by corrosion of both steel and iron fastenings and fittings and the total removal of said fastenings, no ferrous metals were used in the refastening process. Instead the following metals were used as listed:

- Silicon bronze: traditional csk woodscrews used in all hull plank re-fixing and in re-fixing of beam shelves and stringers
- Brass: flat bar used to form all replica frame butt straps
- Copper: round bar used to form through fastenings for butt straps and for through double frame fixings; copper boat nails used to re-fix oak bent timbers
- Stainless steel: threaded bar (various sizes) used to fix scarps and inserts in deck beams; as fixings in hanging and lodging knees; main ballast keel bolts and stem and after centre line fastenings; nails in deck planks, csk woodscrews in covering boards

ADHESIVES

The wood adhesives used on plank and frame repairs and replicated accommodation components were:

- Cascophen Resorcinol resin wood adhesive
- Cascamite urea formaldehyde wood adhesive
- Evode PVA wood adhesive was used on interior accommodation replicated structures

The issues that surrounded *Asgard* may also apply to other vessels deemed significant, and a consideration of those issues will strike a chord amongst all who care for unique and historic craft. *Asgard* is suffused with history and has survived with a hull that is approximately 70%

original, including her wooden deck, in place now over a century. During the conservation programme the original total shrank approximately 10% with the necessary removal of badly-degraded wood. But at the end of the programme, *Asgard* will have the great majority of her original hull structure.