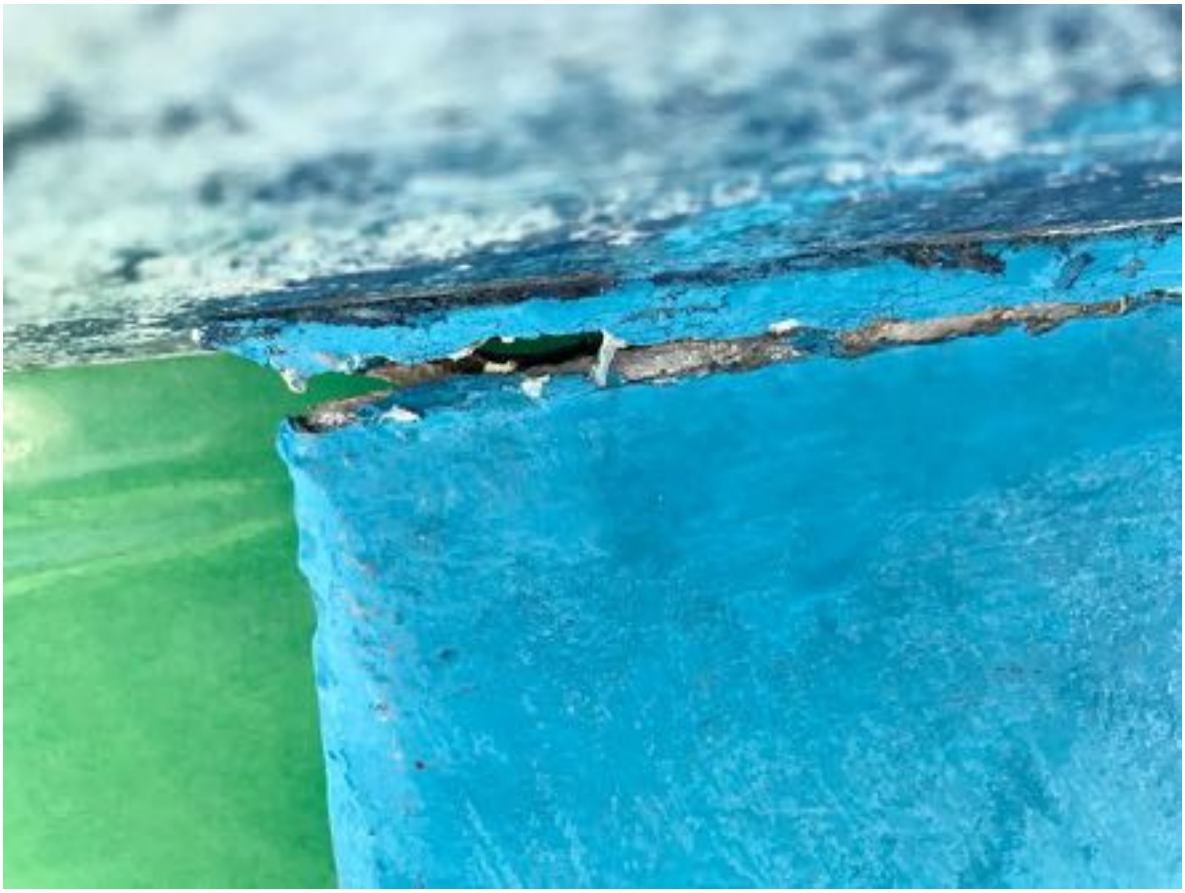
fieldhouse yacht surveys

TRAILBLAZER

Keel Damage Survey



Completed for

[Name & Address removed]

On Thursday 4th March and Wednesday 24th March 2021

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Law and Jurisdiction

This document is to be construed under English Law and English Law shall be used in interpreting the document and for resolving all claims or disputes arising out of or connected with the document.

1. INTRODUCTION

1.1. This is to certify that Nic Fieldhouse, Principal Surveyor of Fieldhouse Yacht Surveys, carried out a Damage Inspection on TRAILBLAZER in accordance with instructions received from *[Name & Address removed]*.

1.2. Nic Fieldhouse received a telephone call from *[Name removed]* on Tuesday 2nd March 2021. Xxx described that whilst TRAILBLAZER was held in the lifting slings of the boat hoist, a gap between the forward end of the keel and the hull could be seen. Xxx estimated that this gap was 6 to 8mm in size, but reduced to nothing when the vessel was resting in its cradle. Xxx noted that when inspected from inside the vessel and when the vessel was in its cradle, there was no visible gap between the keel studs and the hull.

1.3. The inspection of TRAILBLAZER was conducted by Nic Fieldhouse, Principal Surveyor of Fieldhouse Yacht Surveys on Thursday 4th March and Wednesday 24th March 2021.

1.4. The main objective of the damage survey and this report was to assess & report on the condition of the keel, the hull moulding and the internal hull support structure in the region of the keel studs. Recommendations are also given for the repair of the damaged structure.

1.5. TRAILBLAZER was inspected on 4th March whilst she was ashore and held in a steel cradle, located in the eastern boat yard at Port Solent Marina, Hampshire.

1.6. A second inspection of TRAILBLAZER took place on 24th March whilst the vessel was held in the two lifting slings of the boat hoist at *[Name removed]* Marina. This inspection was continued after the vessel had been placed back into her steel cradle.

1.7. The inspections were carried out in accordance with Fieldhouse Yacht Surveys Standard Terms and Conditions and with relevant codes of practice published by the International Institute of Marine Surveying.

1.8. Those present during the inspections were:

[Name & Address removed] (for parts of the inspections)

Eur Ing Nic Fieldhouse BEng (Hons) CEng MIMechE AssocIIMS

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2. SCOPE & LIMITATIONS

2.1. TRAILBLAZER was inspected on 4th March whilst she was ashore and held in a steel cradle, located in the eastern boat yard at *[Name removed]* Marina.

2.2. A second inspection of TRAILBLAZER took place on 24th March whilst the vessel was held in the two lifting slings of the boat hoist at *[Name removed]* Marina. This inspection was continued after the vessel had been placed back into her steel cradle.

2.3. During both inspections, there was good, all-round access to the exterior of the hull. The only obstructions were those presented by the four support posts of the cradle and the two lifting slings of the boat hoist. Access to the bottom of the keel was limited to the parts not resting on two timber blocks and the base of the cradle.

2.4. Internal inspection was limited to the areas forward, aft, either side of the keel fastenings. Additionally, this inspection was limited to the areas that are normally accessible directly or through lockers, inspection hatches, removable panels, etc. No part of the vessel was dismantled; no bolts were removed for inspection and no linings removed, except for the central saloon chair, which was removed in order to access the keel supporting structure beneath. Consequently, any part of the vessel, her equipment or fittings, which were unexposed or inaccessible, cannot be confirmed to be free from defect.

2.5. We have not inspected fibreglass laminate, woodwork or other parts of the structure which are covered, unexposed or inaccessible and we are, therefore, unable to report that any such part of the structure is free from defects, rot or deterioration.

2.6. The vessel and her equipment were not assessed for design or suitability for any particular purpose, or compliance with any rules, regulation, standard or code.

3. VESSEL PARTICULARS

3.1. DETAILS

Name	TRAILBLAZER
Hull Identification Number (HIN)	*[Removed]*
Official Number	*[Removed]*
Registered Tonnage	*[Removed]*
SSR Number	*[Removed]*
Built by	*[Removed]*
Model	42
Type	Fin keel, Bermudian sloop, GRP construction
Build date	November 1998, as indicated by HIN

Table 1: Vessel Details

4. DESCRIPTION OF KEEL & HULL STRUCTURE

4.1. KEEL FASTENINGS

4.1.1. The cast lead keel was secured to the hull by twelve M24 (24 mm diameter) stainless steel studs. Each stud was locked with two stainless steel nuts and a 8mm x 63mm diameter stainless steel penny washer. The forward-most and aft-most studs (numbers 1 & 12 in Figure 3) were supported by 7 x 78 x 130 stainless steel backing plates. The central studs (numbers 2 to 11 in Figure 3) were installed in pairs, with each pair supported by a 7 x 78 x 255 stainless steel backing plates. All stainless steel items were non-magnetic, indicating that they were constructed from 316 grade (A4) stainless steel. Note that the inferior 304 grade (A2) stainless steel sometimes has magnetic properties.

4.2. HULL INTERNAL MOULDING

4.2.1. A Hull Internal Moulding of GRP was located beneath the sole boards. This Internal Moulding was bonded to the hull and strengthened & stiffened the hull moulding around the keel fastenings. It transferred the loads from the mast, via the mast compression post, to the keel. This moulding also transferred the loads from the shrouds to the hull.

4.2.2. Within the saloon there were a number of removable sole boards located above the keel fasteners and above the electric bilge pump (located aft of the keel studs). These were lifted in order to inspect the internal hull and stiffening structure. Access to the hull structure was also gained by lifting the sole board in the forepeak that was located just forwards of the main bulkhead & mast compression post.

4.2.3. The exposed surfaces of the Internal Moulding were finished in brown gel-coat. The Internal Moulding was secured to the hull by GRP tabbing. It could not be determined if the top hat sections of the Internal Moulding included a ‘flange’ at the lower end of each web. The GRP tabbing was applied to the vertical webs of the Internal Moulding and also applied to the hull surface. The hull internal surface and the GRP tabbing were finished with a white bilge paint.

5. DESCRIPTION OF DAMAGE

5.1. HULL-TO-KEEL JOIN

5.1.1. During the inspection of 24th March, the boat was initially supported by its steel cradle. When the boat was lifted off the cradle using the boat hoist, a gap appeared in the hull-to-keel-join at the aft end of the keel. Paragraph 1.2 describes that *[Name removed]* noted a gap at the forward end of the keel when the boat was lifted on or around 2nd March. The reason for the gap appearing at the forward end and then at the aft end could not be determined, but this may have been due a slight difference in pitch of the vessel during the two lift dates. A difference in boat pitch would change the relative loadings on the forward and aft keel studs, thus opening up the gap at one end more than the other.

5.1.2. The gap at the aft end of the keel (seen on 24th March) was a maximum of 5mm, tapering to zero over a distance of 130mm when measured in the fore-aft direction. A smaller gap at the forward end of the keel was noted. This gap was maximum 2mm, tapering to zero over a 100 mm distance. The 5mm gap at the aft end of the keel is shown in Figure 1.

5.1.3. In all other areas of the hull-to-keel join, the semi-hardening stopping compound was found to be bonding well to both surfaces, but with some evidence of movement along the joint, shown as cracking of the antifouling paint that had been applied over the stopping compound.

5.2. HULL EXTERIOR

5.2.1. In order to identify if any hull damage had developed around the keel, the external surfaces of the hull around the keel were tested with a small ball pein hammer. The test gave sound returns with no indications of fracture, softening, poor lay-up or delamination of the hull.

5.2.2. The hull antifouling was scraped off in all of the areas immediately adjacent to the keel root. Particular attention was paid to the areas around the forward & aft ends of the keel root. No evidence of cracking or crazing of the gel-coat was found.

5.3. KEEL CASTING

5.3.1. The keel was inspected, except where the bottom of the keel was hidden by the two timber blocks and the base of the cradle. Evidence of impact damage was noted along the lower edge, particularly near to the forward end and on the port side. These areas of damage were all coated in antifouling paint, indicating that these had existed for some time.

5.3.2. The aft, lower corner of the keel was found to be bent to port. The antifouling paint around this deformation was found to be missing and parts of the exposed lead material were exposed. This area of damage is shown in Figure 2.

5.4. HULL INTERNAL MOULDING

5.4.1. Figure 3 shows a plan view of the part of the Hull Internal Moulding that was located aft of the main bulkhead and forwards of the engine bed.

5.4.2. Where accessible for inspection, visual inspection and hammer testing revealed a number of areas of cracking and debonded tabbing. These are shown by the red and green lines in Figure 3. It was also found that the stainless steel backing plates beneath keel studs numbered #1, #10 and #11 were found to be bent into a concave shape.

5.4.3. There was evidence of a relatively recent application of bilge paint around keel studs #2 to #5. This indicates that the hull & stiffening structure in this region may have been repaired in the past.

5.4.4. A star-shaped crack was found in the hull moulding, located immediately forwards of the forward-most stud (stud #1). The location of this crack was approximately in the same region as the forward end of the keel (Figure 4). This crack indicated that the internal stiffening structure may have been damaged as a result of an upward load on the forward end of the keel. Figure 4 also shows linear cracking around the top hat sections surrounding stud #1.

5.4.5. Figure 5 shows a 220mm long section of debonded GRP tabbing around studs #2 to #5.

5.4.6. The top hat sections of the Hull Internal Moulding were fitted with limber holes, to allow bilge water to drain between compartments. In order to assess the condition of the GRP tabbing between the webs of the top hat sections and the hull, an endoscope was inserted into a number of these limber holes. Figure 6 shows a view looking forwards, towards stud #1. This view shows that a crack exists between the web of the Hull Internal Moulding and the GRP tabbing or bonding paste that secured the top hat section to the hull.

5.4.7. Figure 7 shows an endoscope view looking aft, towards stud #12. Although this image is of poor quality, it clearly shows a dark gap between the Hull Internal Moulding and the floor of the hull. With the endoscope pointing to the same location, this device was set to record on video mode. The vessel was then lowered down onto its cradle. The video was then played to determine if the gap shown in Figure 7 closed. The video recording confirmed that the vertical web of the Hull Internal Moulding at stud #12 moved downwards, closing the gap. This video can be seen through the following link:

Boat_lowered_onto_keel.mp4

5.4.8. This video provides evidence that in the region of stud #12, there is a break in the bonded joint between the Hull Internal Moulding and the hull. When the vessel is held in the lifting slings (or when afloat), the weight of the keel pulls the hull downwards, opening up the gap between the Hull Internal Moulding and the hull. This is seen on the outside of the vessel as a gap between the aft end of the keel and the hull.

6. METHOD OF REPAIR

6.1. Before the keel securing nuts are loosened or removed, the length of the protruding thread of all twelve studs should be measured and recorded. These values represent the maximum amount of GRP repair & reinforcement that can be applied beneath the studs and their backing plates.

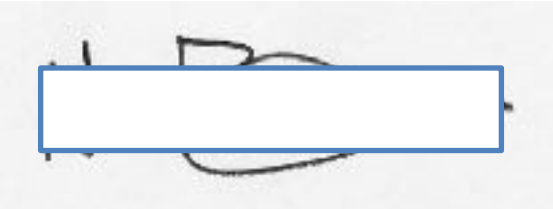
6.2. The cast lead keel should be removed and placed in a keel cradle. This will enable the stopping compound of the hull-to-keel join to be fully cleaned off, but will also enable new layers of GRP (described in paragraph 6.5) to be applied beneath the stainless steel backing pads of the keel studs.

6.3. In addition to the four pads of the boat cradle, the lower parts of the hull should be supported in as many locations as possible with timber blocks and large backing pads.

6.4. Once the soft furnishings have been removed from the vessel, the areas of hull repair should be suitably closed off with plastic sheeting and tape. As is normal practise, dust extraction should be used during the repair work in order to create a partial vacuum in the repair area, minimising any dust leakage into the rest of the vessel.

6.5. All damaged GRP tabbing and laminate in the areas described in section 5.4 should be cut out. All bilge paint should be removed from the areas surrounding the repairs. A common method of repairing the debonded joints between the Hull Internal Moulding and hull moulding is to cut away the bottom flanges of the Hull Internal Moulding. As mentioned in paragraph 4.2.5, it could not be determined if flanges exist at the lower end of each web on TRAILBLAZER. This will become evident when the damaged GRP tabbing is removed from the hull. The vertical webs of the Hull Internal Moulding should then be joined to the hull with layers of GRP, alternating between layers of mat and woven cloth. Ensure that the repairs extend all of the way up the vertical webs of the top hat sections of the Hull Internal Moulding. The layers of repair should be tapered in order to prevent stress concentrations due to sudden changes in laminate thickness. Ensure that as many layers as possible run beneath the stud backing plates, but taking into account the length of the keel studs, to ensure that the locking nuts will fully engage on the threads of the studs. The new repairs should be thicker and stronger than the removed laminate.

6.6. Prior to reinstalling the keel, all distorted or bent backing plates should be replaced.



Date of publication: Friday 26th March 2021

7. PHOTOGRAPHS OF DAMAGE OF TRAILBLAZER

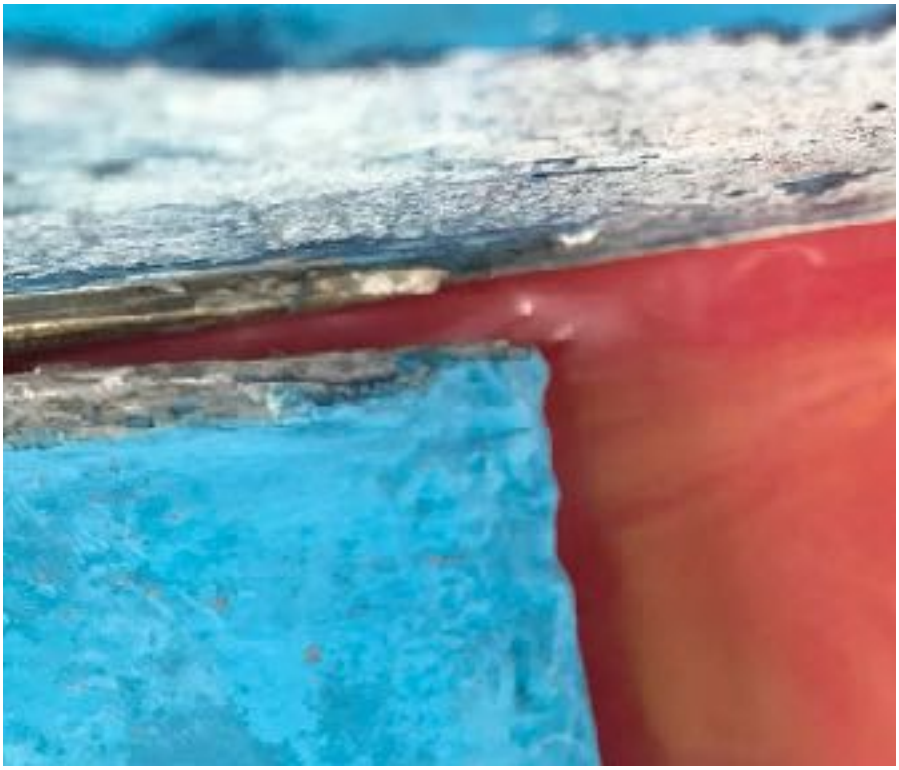


Figure 1: 5mm gap at aft end of keel when vessel suspended in slings

Figure 2: Bent keel at lower, aft corner

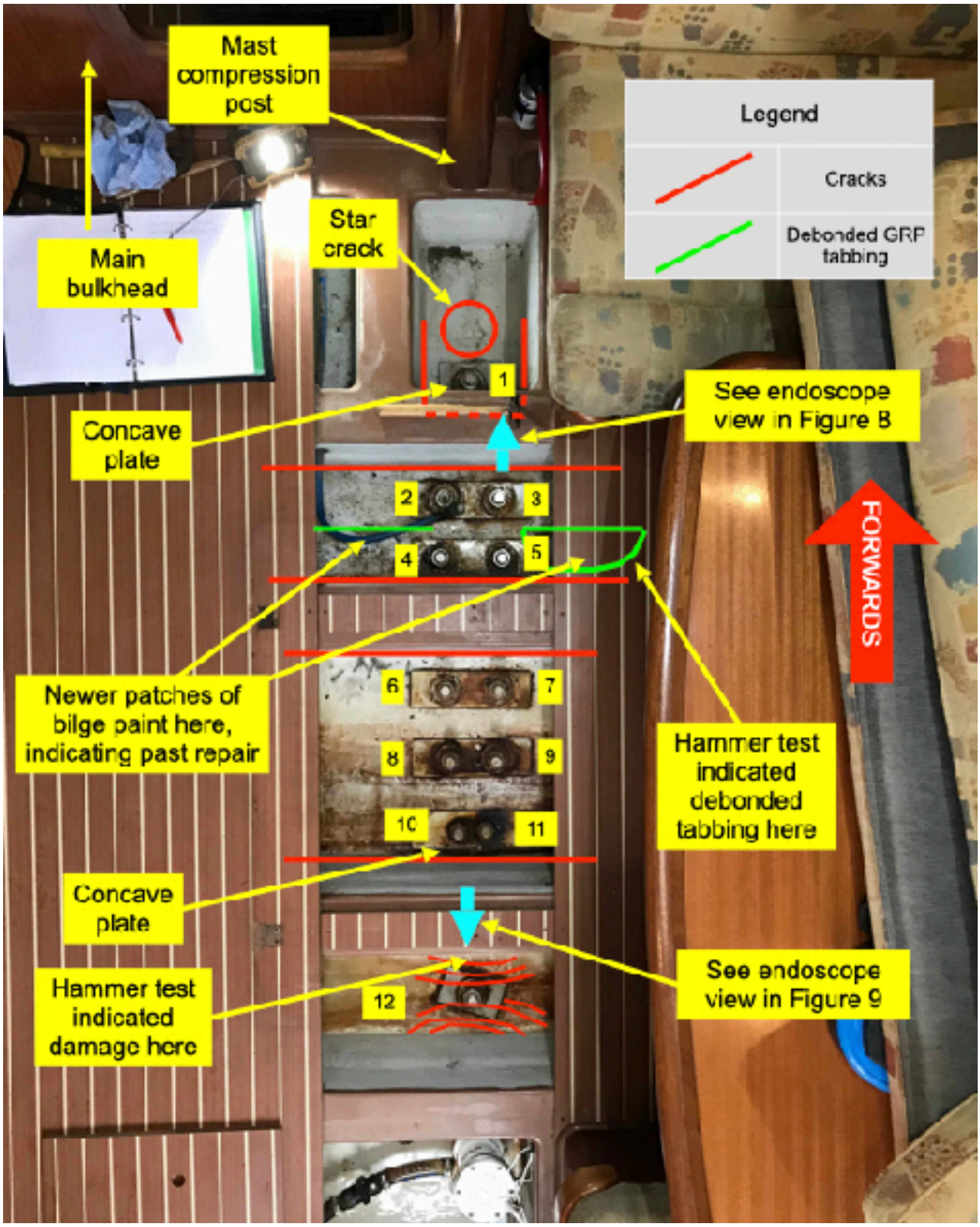


Figure 3: Plan view of Hull Internal Moulding around keel studs

Figure 4: View of damage at forward-most keel stud (stud #1)

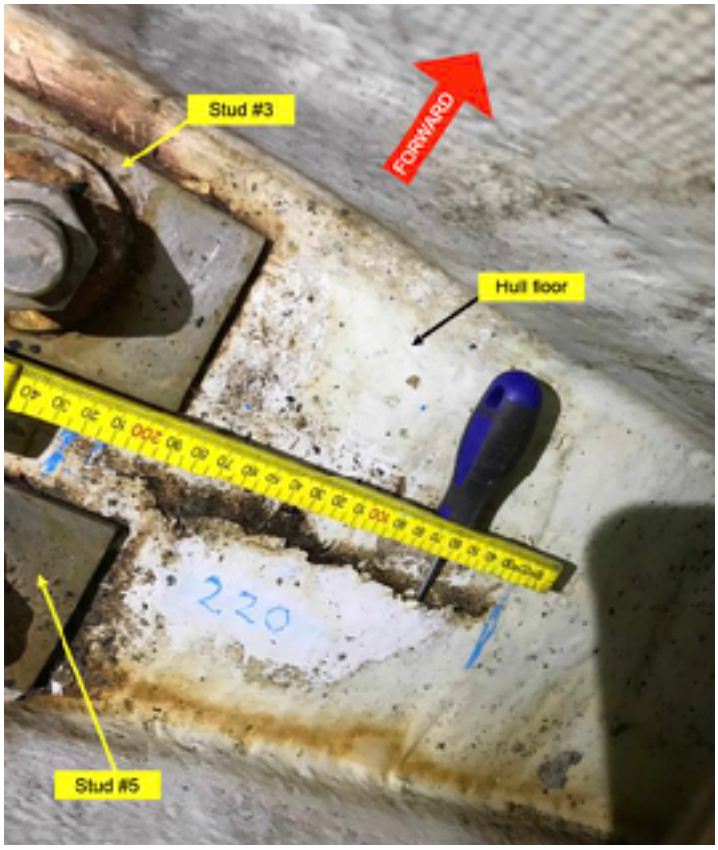


Figure 5: Debonded GRP tabbing at keel studs #3 & #5

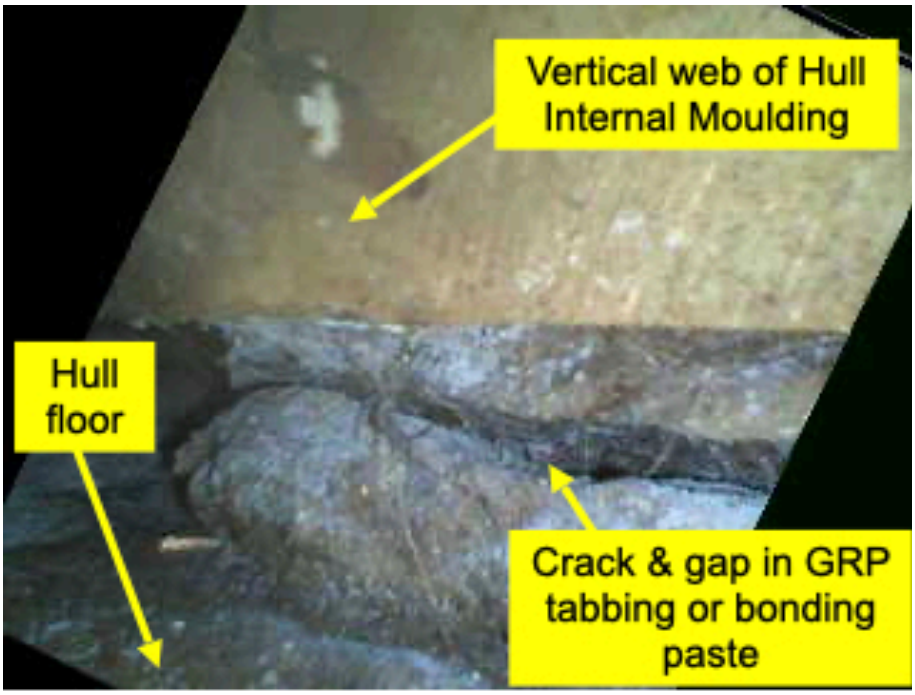


Figure 6: Endoscope view looking forwards towards stud #1, inside top hat section

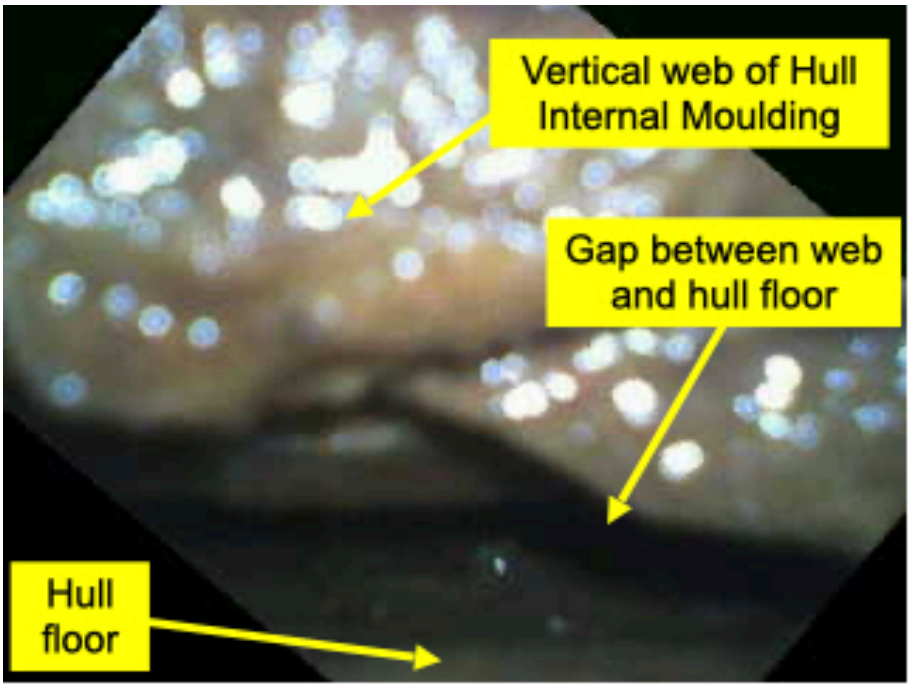


Figure 7: Endoscope view looking aft towards stud #12, inside top hat section. See video showing gap closing when vessel lowered onto keels