REPORT OF LIMITED SURVEY

(Hull Bottom & Structure)

S/Y "PIXELION"

Baltic 64

File No. SP32002

1. DESCRIPTION OF THE VESSEL, SURVEY CONDITIONS

'PIXELION' is a Baltic 64 auxiliary cruising sloop built in FRP (Glass & Aramid / Epoxy resins) by Baltic Yachts, Finland, in 1997 to a Sparkman & Stephens design.

The vessel is currently reportedly registered in France with homeport Toulouse; however, no registration papers were inspected.

No HIN number as sighted on the transom but, due to the build prior to commencement of the Recreational Craft Directive (RCD), it is not required.

The construction number is XYB640050297; hull number is 64/005.

Her principal dimensions as supplied by the manufacturer are: LOA 19.51m, Beam 5.27m, Draft 3.53m, and approximate displacement 25.5 t.
The colour of hull is blue with white deck and superstructure.

The vessel was examined both ashore and afloat in Palma de Mallorca, Spain, on 26th of January 2018.

As per specific instructions received from Mr. Pierre Philippe Giraud, the survey was limited to verifying the structural integrity of the vessel. As a result the Survey of the vessel was limited to the hull bottom, internal hull bottom and structure.

The purpose of this survey was to ascertain the condition as specified above prior to purchase.

2. INSPECTION METHODS, PRINCIPLES, & DETECTABLE DEFECTS

Inspection methods employed:

Visual Inspection, Acoustic Response (hammer tapping), and Infrared Thermography.

Instruments employed:

- Thermographic Camera - Flir T-620; Serial No. 55904601.

General Note:
All our NDE instruments are calibrated according to manufacturer's recommendations. Furthermore, they are calibrated by our inspectors whilst on the project to ascertain that local conditions do not alter the results. This includes where feasible the individual calibration to the exact velocity of the material in use.

PRINCIPLES OF ACOUSTIC RESPONSE (TAP TESTING)

Tap test is basic technique for inspecting composite structures such as FRP sandwich panels. The technique consists in tapping with a small ball-peen hammer on the surface and evaluates the acoustic sounds produced.
A skilled operator is capable of detecting planar discontinuities such as delaminations and core disbonds.

PRINCIPLES OF INFRARED THERMOGRAPHY (IRT):

Every material emits thermal energy to the environment in the form of invisible infrared (IR) radiant energy. Infrared Thermography is a technique that makes radiant energy visible and measurable, hence capable of detecting a number of defects within a composite structure.

Thermographic inspection of composite stuctures requires the induction of a temperature gradient (known as Active Termography). The temperature gradient was induced to the parts inspected by radiation (lamps) suitably sized and positioned to achieve the desired heat wave necessary for the inspection.

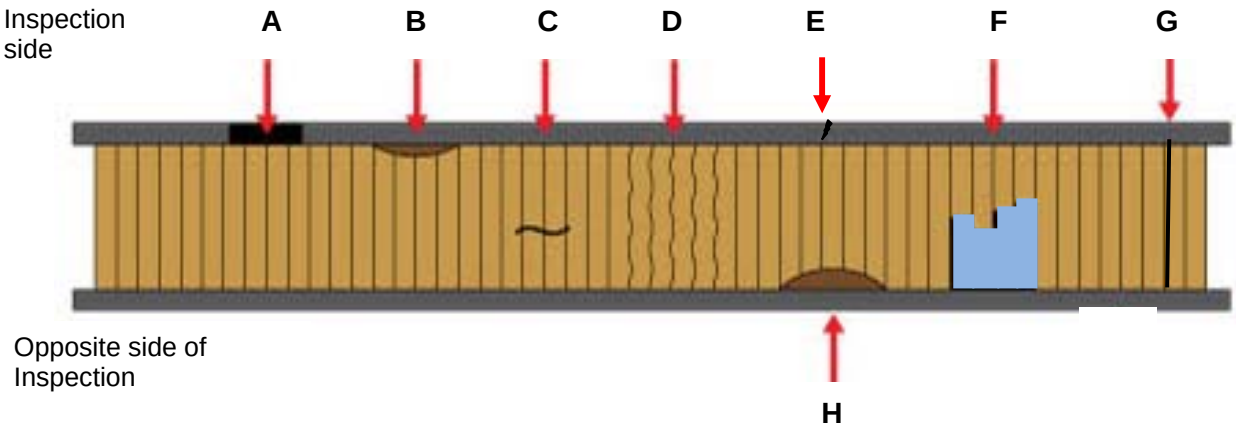
The fact that different materials radiate heat in different ways enables the inspector to detect and record anomalies within a structure, not visible by naked eye. Areas which contain air entrapments or which are not well bonded to the substrate show a higher temperature than well-consolidated areas. Areas containing fluids show as colder areas.

Please note that the colour range in post-processed images is not necessarily related to a temperature scale.

TYPES OF DEFECTS DETECTABLE

The NDE (Non-Destructive Examination) methods employed for the inspection are capable of detecting a variety of anomalies in composite structures.

Samples of Defects in Sandwich Construction:



Defect A: Delamination between plies of outer CFRP skin.
Defect B: Disbonding between the outer skin and the core.
Defect C: Cracked core parallel to the inspection surface.
Defect D: Crushed core.
Defect E: Linear breakages transversal to the laminate.
Defect F: Fluid ingress in honeycomb core.
Defect G: Core splice disbonds.
Defect H: Debonding between inner skin and core.

Defects can be broadly divided into 4 categories:

TYPE 1 – PLANAR DISCONTINUITIES: Such as Delaminations between plies, Disbonds between core and skin(s), Disbonds of adhesive or secondary bonds, large gelcoat / fairing or inter-laminar, Bridging of taping connections (tabbings), Voids, etc.

TYPE 2 – TRANSVERSAL CRACKS: Linear breakages transversal to the laminate stack. This may affect only the coating (paint, gelcoat, fairing, etc) or extend into the underlying laminate, and core (core splice disbonds).

TYPE 3 – WATER INGRESS: Water in core, and other Environmental Ingress (such as diesel, solvents, etc).

TYPE 4 – OTHER DEFECTS: Dry fibers (from lack of resin infusion or poor impregnation), Excess resin, Micro-cracking, Porosity, Crushed core, Inclusions, etc

It should be noted that some types of defect are manufacturing related whilst other develop under service conditions and/or exceptional events.

NDE TERMINOLOGY

Indication - an irregularity or inhomogeneity in the inspected part detected only by a single NDE technique.

Anomaly - an indication confirmed by a second NDE technique; however, missing interpretation to be relevant or non-relevant.

Defect - one or more anomalies whose aggregate size, shape, orientation, location, or properties do not meet specified acceptance criteria.

3. BOTTOM EXTERNALLY

Preparation for bottom survey: the yacht was found hanging in the travellift belts having been hauled and washed the day prior to the inspection. Due to arrangements within the yard the launch time was brought forward by a number of hours which, together with deterioration if the weather, limited the scope of the survey to some extent.

The hull construction is sandwich type laminated in a female-mould using a combination of glass and Aramid fibre reinforcements with epoxy resins and vacuum consolidated. Core material is end grain Balsa wood throughout.

The hull was found to be fair in all the underwater areas with no signs of damage. The used paint scheme was mostly in serviceable condition with the antifouling requiring a new coat prior to the next season. [1]

Only coatings to the lead keel were in unsatisfactory condition with paint scheme missing in large sections. [2]

The L-shaped lead keel features integral stainless steel keel bolts. The keel appendix as a whole was seen in satisfactory order and showed no evidence of having taken grounds; however, the flexible compound at the joint to the hull would benefit from renewal. [3]

The rudder is a semi-balanced, free-hanging spade made of CFRP with no visual anomalies.

The bow-thruster tunnel has been retrofitted and would benefit from some attention to the fairing around its perimeter. [4]

The entire hull was both acoustically sounded and inspected using non-destructive means. The former identified a number of locations with possible defects to the bond line between outer skin and core with also Infrared Thermography indicating that former propping positions have partly detached outer skins from the core. Those areas are all at the turn of the bilge, four on the port side and two to starboard. Although at this point not deemed of structural concern, it is best to investigate the issue further and rectify accordingly. [5]

Infrared Thermography also depicted a previous repair at the bottom of the rudder.

Electronic moisture detection was carried out using a Tramex moisture meter over the antifouling. In most areas the readings compromised between 20 and 40 of the meters scale 1. This is deemed a satisfactory level given that the vessel was only hauled out the day before.
In a few isolated areas the meter was noted to show readings in excess of 80 with Infrared Thermography confirming high humidity. However, testing following removal of the antifouling confirmed that the moisture was limited to the paint scheme and not caused by water ingress into the core.

Note: Moisture meters do not give actual percentage of water in the GRP laminate but "relative returns". Interpretation of the Tramex relative scale (Range 1) is as follows: readings of 10 or less the laminate can be considered as " dry" (good), readings from 10 to 40 as "moist" (from satisfactory to serviceable accordingly to age and service life of the vessel), and anything over 40 as "wet or saturated" (unsatisfactory).

UNDERWATER GEAR

The vessel is fitted with stainless steel (duplex) drive shaft supported by a bronze P-bracket. Stern tube and P-bracket are each fitted with a cutlass bearing; both were seen in satisfactory condition.

The propeller is a self-feathering, 3-bladed bronze "Gori", marked as 26x18.
The propeller was noted to be slightly loose on the shaft, shows excessive play between blades and hub, and with the polymer blade cushions due for replacement. [6]

The electrically operated bow thruster is housed in a retrofitted GRP tunnel and fitted with twin 3-blade plastic propellers in serviceable condition.

4. BOTTOM INTERNALLY & INTERNAL HULL STRUCTURE

The majority of the cabin sole is easily removable for inspection. However, in some areas the inspection to the internal bottom is highly restricted by fitted stainless steel water and fuel tanks or pre-moulded fixed FRP structures such as the heads.

The hull is internally stiffened with longitudinal and transversal FRP 'top hat' reinforcements both above and below waterline.

Bilges are mostly well finished with original coating and are generally in satisfactory condition.

Internal hull bottom area was fully inspected by visual means and no anomalies were noted to the primary hull structure.

However, the anchoring of the floor structure at the base of the starboard forward hanging locker, was noted damaged. [7]

Keel bolts are accessible from the saloon. The installation was closely inspected and the following noted:

- The keelbolts are all fitted with a single nut only. No locking nut or other means of securing was noted. [8]
- Large stainless steel backing plates link the bolts between frames. Although a good practise, they were not bedded down with only corners touching and a void between the plates and the hull. [9]

Reportedly the keel has been altered from the original extended keel to a standard keel profile. It is likely that during this modifications the backing plates were added as the keel-bolts were now oversized in length.

5. CONCLUSIONS

This nearly twenty year old fast cruising vessel appears to be structurally in good order.

However, it is recommended to haul the vessel out in the not too distant future for an extended period and to rectify the issues related to the keel and the bottom coatings. At the same time it should be considered to investigate further the indications that the core has debonded in isolated areas due to improper blocking of the vessel ashore.

This survey report is prepared exclusively for:

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It is understood that the Surveyor's report is a factual statement of the examination carried out within stated limitations and with opinion given in good faith as far as seen at the time of survey. It implies no guaranty against faulty design, hidden or latent defects or suitability of the vessel for a particular purpose. The Surveyor will not accept any liability for any omission, default or error of judgement where his examination is limited due to inaccessibility or to any part of the vessel excluded by the client. All areas examined are indicated in the report.

This report consists of eight pages and is prepared on January 30th, 2018.

Signed without prejudice.

Felix Bussmann,
Associate Surveyor
NDT Technician
Marine Survey Bureau

FINDINGS AND RECOMMENDATIONS

The following code denotes the importance of the recommendation. These recommendations should be considered as a guide only and not exhaustive.

A. Structural, mechanical or other defects affecting strength, seaworthiness or safety that require immediate attention.

B. Non-structural or mechanical defects not requiring immediate attention but are to be monitored or dealt with at the earliest convenience.

C. Non-essential or cosmetic defects whose repair may be left to the owner's discretion.

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[1] Antifouling requires renewal prior to the next season. **(B)**

[2] Coatings of the lead were seen in unsatisfactory condition. It is recommended to remove the current paint scheme and start with a new primer base coat. **(B)**

[3] It is recommended to renew, at the next extended haul out, the external bead of flexible compound of the hull-to-deck join. **(C)**

[4] The finish of the bow thrusters tunnel installation is unsatisfactory. It is recommended to remove all loose filler, re-fair the area, over-laminate, and finish with primer and antifouling. **(C)**

[5] Both acoustic response and Infrared Thermography indicated that amidships, along the turn of the bilge, are some areas affected by core to outer-skin de-bond. The anomalies, four on the port side and two to starboard, are believed to have been caused by inappropriate blocking of the vessel and measure approx 200mm in diameter. Although at this point not deemed of structural concern it is best to investigate the issue further and rectify accordingly. **(B)**

[6] It is recommended to either fully service or replace the Gori propeller as it was noted to be slightly loose on the shaft, shows excessive play between blades and hub, and with the polymer blade cushions due for replacement. **(B)**

[7] The anchoring of the floor structure at the base of the starboard forward hanging locker was noted damaged. Grind open and re-laminate the tabbing. **(B)**

[8] The keel-bolts should be secured by either adding a second ‘locking’ nut or other means to lock the nut in place. **(B)**

[9] Large stainless steel backing plates link the bolts between frames. Although a good practise, they were not bedded down with only corners touching and a void between the plates and the hull. It is recommended to lift plates and fill the space beneath with a dedicated chocking or grouting material (such as Chockfast) prior to re-tightening according to manufacturers specifications. **(B)**

Photos

General view of the vessel hauled out at STP boatyard

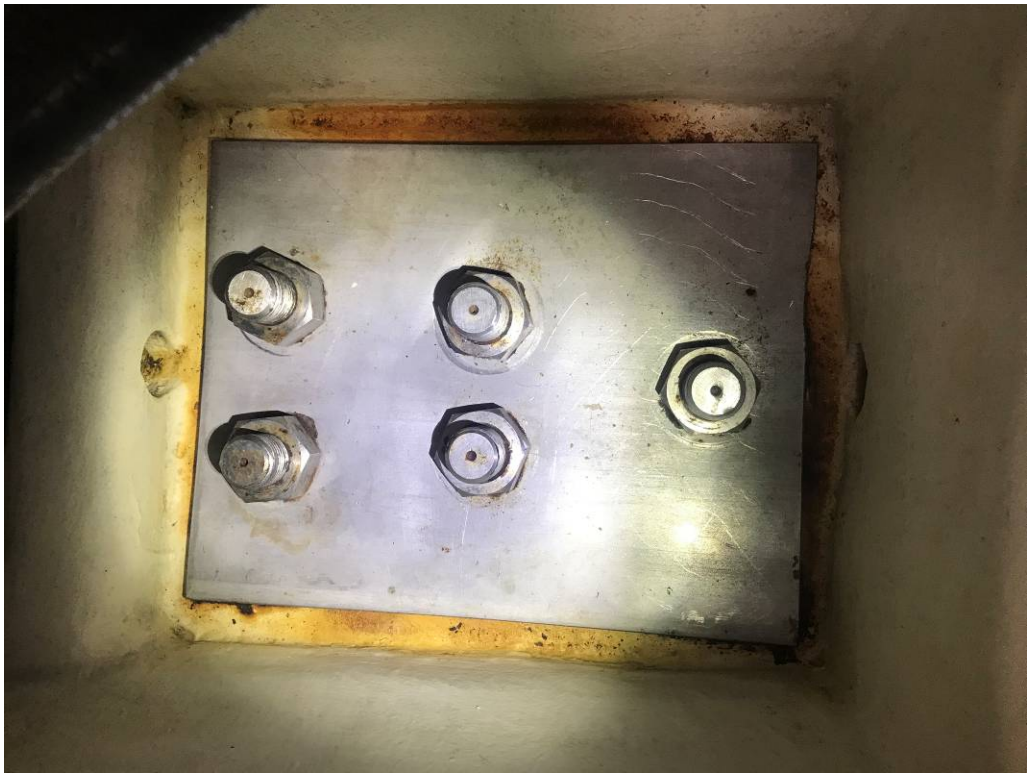
View of the vessel from astern

Overview of keel

Indications of core disbond on port side

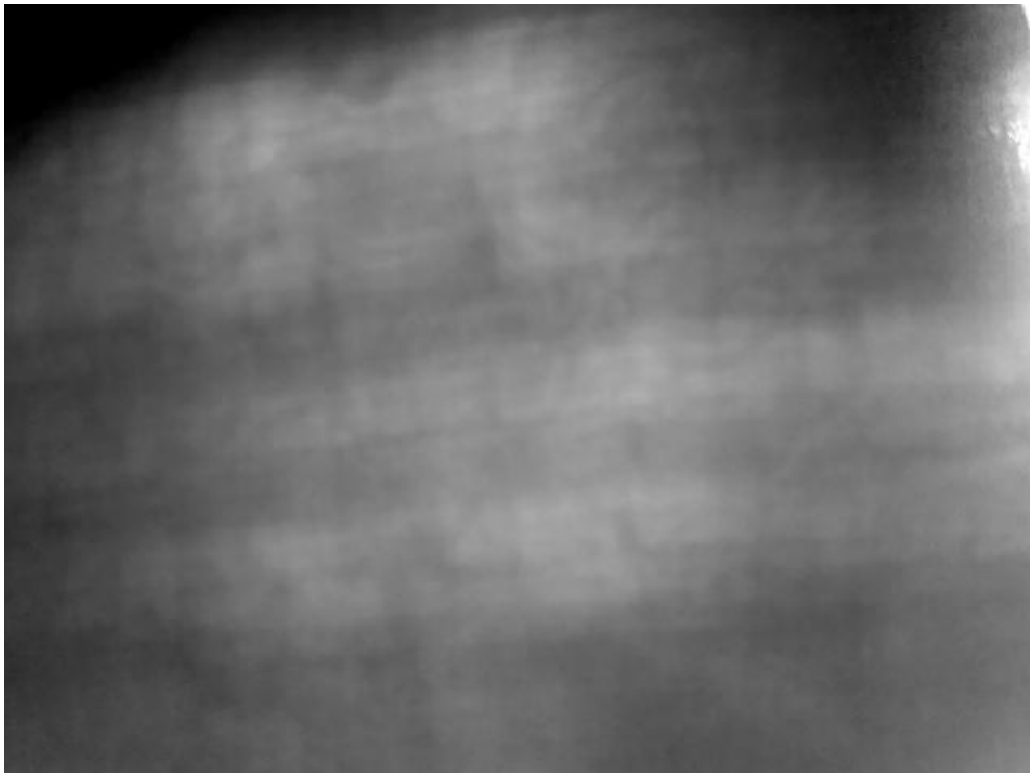
Bow-thruster with fairing peeling off around tunnel installation

Damaged anchoring of secondary structure onto primary reinforcements

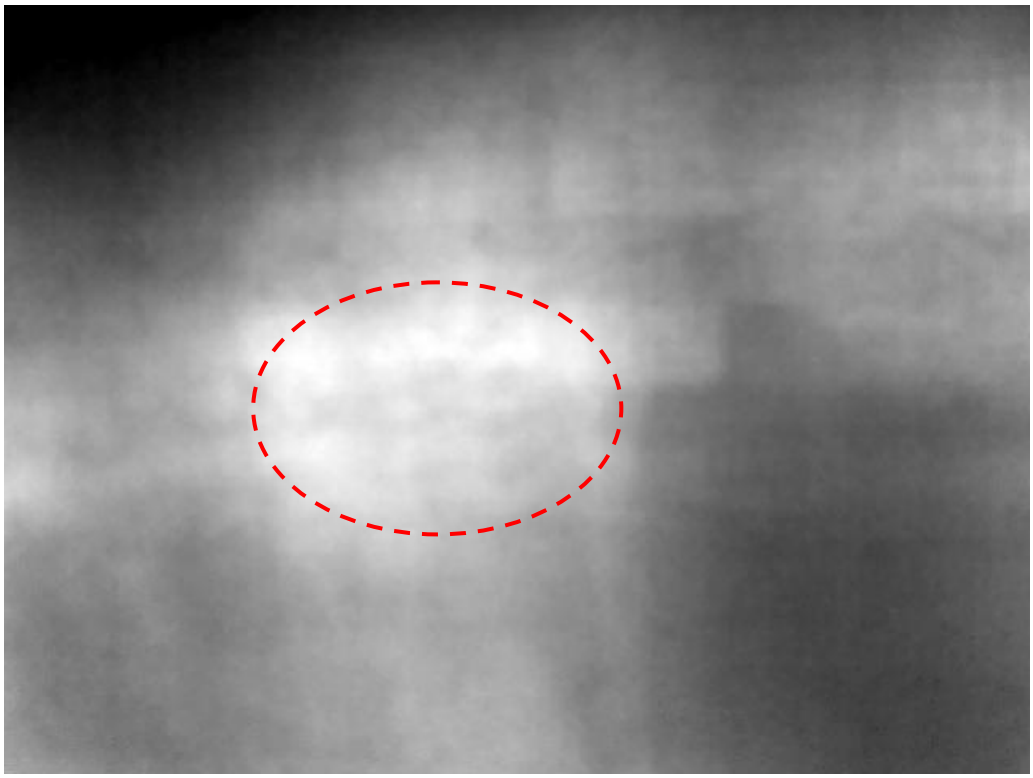


Keelbolts with large backing plate; note absence of locking nuts

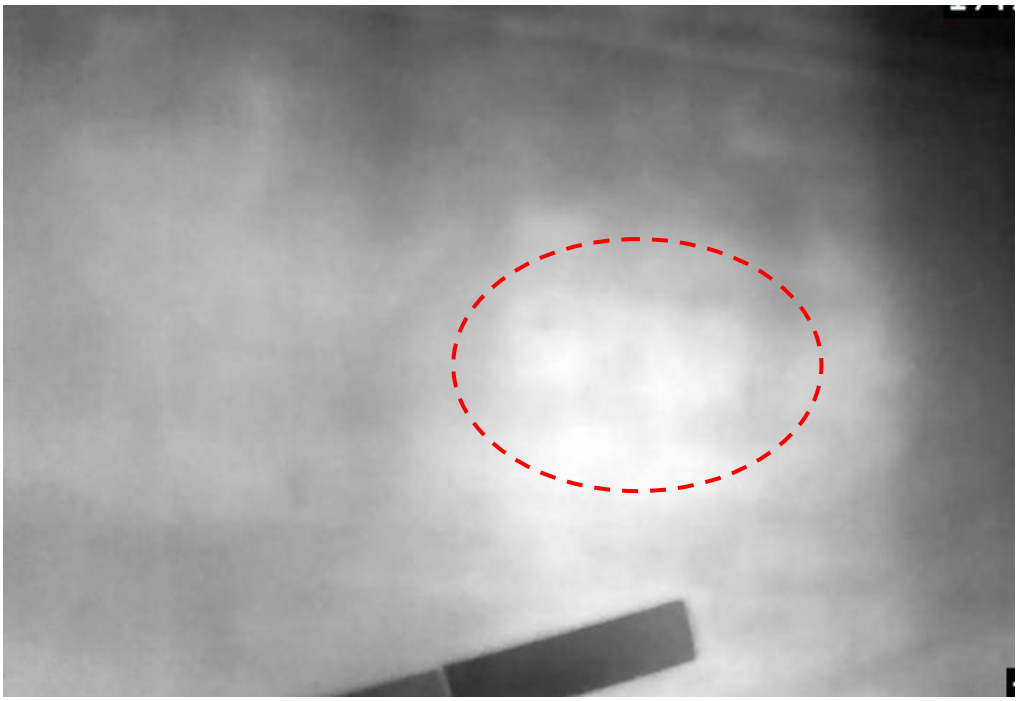
Gap beneath the backing plate



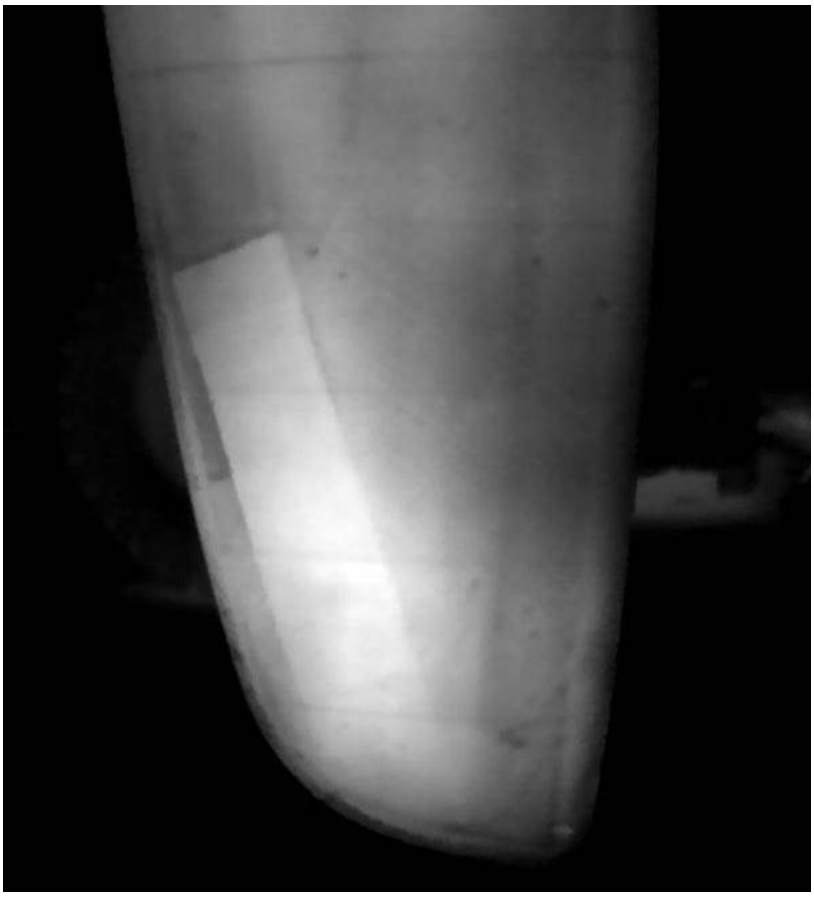
Greyscale thermogram of the hull with Balsa end-grain core visible.
Dark horizontal lines are overlaps of reinforcement fibre



Greyscale thermogram of core disbond indication (port side)



Greyscale thermogram of core disbond indication (starboard side



Greyscale thermogram of rudder tip with repair clearly visible