MEDUSA
MARINE

Condition and valuation report on:
Vindo 32 *Swedish Lass*

For:
Mr Grahame Hill

Member
Royal Institution
of
Naval Architects

Richard R Thomas BA(hons) MRINA T/A Medusa Marine
236 Walton Road, Walton on the Naze, Essex, CO14 8LT
01255 674074 – 07831160402 – VAT Reg No. 720 3281 75
email medusamarine@aol.com www.medusamarine.co.uk

Condition Survey Report on Yacht *Swedish Lass*

This survey was carried out on the instructions of:

Mr Grahame Hill
9 Broome Grove
Wivenhoe
Colchester
Essex CO7 9QB

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1) General notes.

a) Responsibility

Any responsibility is to the above client only and their insurers, and not to any subsequent owner of the vessel under survey or holder of this report.

b) Location

The vessel was laid up ashore and under cover at Park Farm, Park Road, Ardleigh, Essex. CO7 7SR on 23rd August 2012.

c) Purpose and scope of survey

This survey was commissioned by the vessels owner for the purpose of establishing the condition of the vessel prior to sale and a valuation. Unless otherwise stated, the vessel was not surveyed for compliance with any build standards (RCD) or operational codes of practice or local licenses. The vessel has also not been surveyed for suitability for any particular purpose or location. This survey report is a factual statement of the surveyor's examination as carried out, and his opinion given in good faith as to the relevance of disclosed facts and defects so far as seen. It implies no guarantee against faulty design or latent defects.

d) Limitations

Areas inspected were limited to openings and access available during normal operations and maintenance of the vessel. No fastenings or skin fittings were removed, keel bolts drawn or joinery or head linings removed. Closed compartments were visually inspected by means of a Ridgid CA100 endoscopic camera. Materials used in the construction were tested as far as was possible by industry standard Non Destructive Test (NDT) test equipment.

Unless the vessel was afloat, the mechanical condition of the engine was not covered by survey, only the installation and components normally available to routine maintenance could be assessed. If afloat, only assessment of the engines no load running condition was possible. Sails where present, were examined for general condition. Sails were not set, so no assessment of shape or stretch could be made. Spars where stepped were examined from deck and ashore only.

Navigational equipment, electrical installations and domestic appliances were assessed subject to limitations if battery charge or shore power was available. If there was no opportunity for sea trialling the vessel, no assessment of the vessel and her equipment under seaway conditions was possible. No opinion could be made or responsibility undertaken for condition or defect of those aspects of the vessel not accessible or evident due to the above limitations.

e) Recommendations

Recommendations have been subdivided into three categories. All recommendations are annotated thus and are summarised at the end of the report

Category 1 (Cat 1) are safety related defects which must be corrected before the vessel is put into commission.

Category 2 (Cat 2) recommendations relate to defects which affect the operation of the vessel in normal use and should be attended to at the earliest opportunity. They do not however, affect the safe operation of the vessel.

Category 3 (Cat 3) recommendations relate to conditions which are cosmetic or may affect the perceived value of the vessel and should be attended to in the next lay-up season.

2) The Vessel specifications and description

Note: Dimensions and measurements given have been derived from manufacturers published data, and have not been verified by survey.

Dimensions:

LOA:	8.95 metres
LWL:	6.45 metres
Beam:	2.75 metres
Draft:	1.30 metres
Displacement:	3.60 tonnes
Ballast:	1.6 tonnes
Manufacturer:	Notesunds Varv AB, Sweden
Model or Type:	Vindo 32
Year of Build:	1979
Hull No.	Not recorded
Designer:	Carl Andersson
Construction:	GRP hull & deck, Coachroof in teak joinery.
Engines:	1 x Volvo 2020 18hp diesel
Mainsail area	15.68 sq M
Headsail area	19.56 sq M

As the vessel was built by in Sweden prior to 15th June 1998 there is no requirement for it to meet the standards of the Recreational Craft Directive (RCD), therefore no such documentation is recorded. No documentation of the vessels VAT status was available at the time of the survey.

Swedish Lass is a Vindo 32 which was built in Henan Sweden in 1979. Vindo Marin AB was the boat building subsidiary of Notesunds Varv AB which translates as Notesunds Boatyard Ltd. The name Vindo originates from the island on which they first built their yachts

The company ceased to trade in the mid eighties, but a successor company trades as a yacht marina and maintenance company under the name Vindo Notesunds AB which maintains and services Vindo yachts and can supply spares and advice. This service can be of considerable benefit to the owner of a yacht which is now 33 years old.

The Vindo 32 was first introduced in 1971 and is a masthead rigged sloop, semi long keeled with encapsulated ballast and a keel hung rudder and propeller in an aperture. She has a conventional sheer line and moderate overhangs. The 'S' plan hull form has some flare forward, transitioning to moderate tumblehome amidships and reverting to moderate flare aft. She has a typically 1970's raked stem and a slightly raked rounded transom. She has a high (45%) ballast ratio and high (3.25:1) length/beam ratio.

This example of the class is Sail No 346 and as related by the owner, was originally purchased locally through an agent in Tollesbury and has spent its whole life on the Colne and Blackwater. She has been extensively cruised around the North Sea coasts of France, Holland and Belgium by five different owners.

3) Survey details

a) Hull general

Hull construction is of solid glass reinforced plastic (GRP) laminates of woven rovings (WR) and chopped strand mat (CSM) bonded with polyester resins. The hull is moulded with GRP flanges moulded where the bulkheads are to be located. The bulkheads are then bolted to these flanges during fit out. This technique eliminates the possibility of the bulkheads showing in the topsides as the GRP fully cures out of the mould. The keel profile is integral with the hull which has been moulded in a split mould to accommodate the tumblehome. This also accommodates the inboard facing flange at the sheer which is also integral with the hull. The hull deck seam is made by landing the deck onto this flange with bonding paste and through bolting.

b) Bottom

The bottom is finished with black anti-fouling paint which was a sound coating free from flaking. The hull was sounded with a small pin hammer and was found to be free of delamination or voids. It was also free from any visible blistering. The keel bottom was inspected with a mirror. There was a clear central line showing where the split mould was joined. The presence of this witness line shows that there has been negligible abrasion to the keel bottom and therefore very little risk of water ingress into the encapsulated ballast. The witness line would have extended up the aft run to the transom and it would

have been polished out in manufacture. Affixed to the aft run beside the rudder was a sacrificial anode. There were clear signs of antifouling paint on the surface of the anode.

Recommendations

(Cat 1) Replace the sacrificial anode. Anodes must not be painted over as the surface must be exposed to the water to function properly.

Small areas of antifouling were scraped back to gel coat and it was found that the hull bottom had been coated with epoxy of a green hue consistent with it probably being International Gelshield. This is assumed to have been a preventative rather than a curative treatment. Although Gelshield is a solvent free epoxy, being a painted coating it cannot be guaranteed to be free of micro bubbling left from the mixing of the two components. These can sometimes retain moisture which has permeated through the antifouling. This does not mean the coating is permeable as there should have been a minimum of five coats applied.

Moisture readings were taken with a Tramex Skipper Plus Marine Moisture meter. This meter is a capacitance type tester and is equipped with both deep and shallow reading scales. These can be used to eliminate spurious readings generated by water or metallic components inside the bilges. The comparative scale is 0 to 100 which is an arbitrary scale and does not represent actual percentages of moisture in GRP. Thus figures are quoted as scale readings and not as percentages.

Representative readings on a Tramex Skipper Plus comparative scale for moisture content in GRP laminates are as follows:

0-15 Regular readings for a ‘dry’ GRP laminate
15-38 Slight absorbsion typical of permeability of weather exposed GRP
38-55 Medium moisture content, could be osmotic but unlikely to blister
55-100 High moisture with a likely physical degradation at higher ranges

Readings were taken in the topsides for reference and showed a consistent level of 20 to 30. Readings taken from the bottom initially showed unrepresentative high results and so areas of antifouling were removed. The Tramex meter should be able to read through layers of paint but if there are significant metallic elements left in antifouling it can produce false readings. This can usually be established by taking equivalent readings from inside the hull. Up to 10 areas each side of the hull bottom, approximately 75mm square where scraped back and test results recorded. These paint removed areas showed more consistent levels at 32 to 43 on the scale at both the deep and shallow ranges, and readings taken inside the hull corroborated these levels almost exactly. These readings are considered acceptable and taken in conjunction with the complete lack of any physical evidence of damage to the laminate indicates that osmotic blistering is not currently present in the hull.

It must be noted however that this vessel has been out of the water and under cover for at least two years. When a vessel with osmotic absorption in the hull is lifted from the water the process will begin to reverse. The pressure in the pockets or blisters will force the water back out through the membrane in a process called Reverse Osmosis. For this reason moisture readings on this hull cannot be taken as proof that osmosis or blistering has never previously taken place, although any severe deep seated blisters would have been found by the hammer testing (*See explanatory note 1)*

Recommendation

(Cat 2) Re-test the hull for moisture readings when next lifted at the season end. This is best done about two days after the vessel has been lifted to allow surface moisture retained in the coatings to dry off. Beforehand a check should be made of humidity and dew point temperature to ensure that no condensation is present on the hull surface which will give false readings.

The keel is moulded integral to the hull and ballasted with 1.6 tonnes of lead ingots encapsulated with resin as reported in the manufacturer's data. None of this could be examined for condition.

c) Topsides

Constructed of solid GRP laminates with an off white coloured gel coat finish and a burgundy red painted boot top. There is a moulded cove line inset with a gold vinyl tape. The vessels name has been sign written by hand on the transom.

The hull is fair with no distortions visible from bonded in internal structures due to the bulkhead design. There is a fair degree of abrasions and scratches in the gel coat but none penetrate through to the laminates indicating that it was probably double gel coated in the mould. A small area of impact damage is visible on the starboard bow about half height to the topsides. This has broken through to the laminate. There is also an old, poorly executed repair to the port bow.

The stem is protected by a stainless steel stem band which extends down toward, but not all the way to the forefoot. The boot top is painted with a dark red coloured paint which looks to be a copper free type boot top antifouling.

The topsides were tested with a Barcol Impresser. This tests the hardness of the laminate and so establishes the consolidation of the lay-up and the level of cure of the resins. These readings can vary considerably so up to 30 readings were taken around the hull and were averaged to produce an accurate mean of 36.5 HBa. That is very slightly on the low side, (38 to40 is considered normal) but it is consistent with the types of resins that were employed within the industry at the time this vessel was built so it can be considered quite acceptable.

The hardness and cure state of the gel coat is tested with a Shore D Durometer; this is often unreliable as the gel coat can be too thin to get a representative reading. The double gel coat enabled satisfactory readings of 89.5 to 90.5 HSD to be made, which are good. (88 to 90 is considered normal).

Recommendation

(Cat 2) Repair the damage to the gel coat on the starboard bow. This should be locally ground back removing any crazing in the surrounding gel coat. New gel should be colour matched to the original. (*See explanatory note 2)*

(Cat 3) Protect the topsides gel coat from further degradation using polishes containing PTFE compounds. These will provide the same UV protection as silicones, but they do not have the propensity to migrate and cause subsequent refinishing and embrittlement problems. (*See explanatory note 3)*

d) Hull to deck seam

The hull has been moulded in a split mould, and the sheer flange has an inboard facing flange of approximately 7cms which has been moulded integral with the hull. The deck moulding has a corresponding rebate. The hull deck seam is made by landing the deck onto the hull flange with bonding paste and through bolting with M6 bolts spaced about every 30cms.

The joint is not laminated over and the bonding paste is shy in places leaving some voids in the joint. The bolts are clearly to aid assembly and are too infrequent to be considered structural. This construction could have benefitted from the addition of laminate bondings cosmetically as the joint is visible in all the cove lockers and in the deck head in the forepeak. Nevertheless, where seen, there is no sign of movement in the flo-coat which has been applied so it has obviously proved structurally adequate. It is possible that the joint has been laminated over externally where it is cover by the teak decking.

e) Deck

The deck is constructed from cored GRP laminates. The underside laminate skin was sounded by pin hammer and found to be particularly well bonded to the core suggesting that the core material is end grain balsa. Research showed a sister ship was proven to have vinyl foam as a core material, but It is not impossible that, in a production run of some 500 boats over 14 years, the lay-up specification could have changed. The core material therefore could not definitely be established without taking core samples which is outside the scope of this survey.

The deck moulding was tested under the deck head for moisture in the laminate and in the core material. Readings of 15 to 20 on the scale were recorded. Particular attention was paid to areas where the teak planking showed evidence of lifting and also where deck fittings were through bolted. All moisture readings were acceptable, but again should be read in context of

the vessel having been stored undercover for the past two years as detailed in section 3.b

The deck is then covered with cosmetic teak planking bonded down with polysulphide or polyurethane bedding and caulking and secured with screws which have been dowelled over. The teak planks are swept to the sheer with teak covering boards and margins, and the ends are notched into the teak king plank.

This teak decking is in very poor condition. The decking has been eroded by aggressive cleaning by scrubbing or pressure washing. This is evident because the caulking and the grain appears as raised ridges as the soft springwoods between the grains have been scoured out. *(See explanatory note 4)*

Not all of the teak timber stock used was quarter sawn and these planks have suffered particularly badly. Some planks, two by the third stanchion on the starboard side and one by the first stanchion on the port side, have also started to de-bond and lift from the GRP sub deck as a result of the planks cupping. *(See explanatory note 5)*

The erosion of the deck, measured by depth under deck fittings appears to be about 3 to 4mm and removing a screw which was exposed by a lost dowel showed that the original deck was about 12mm thick. This means that the majority of the deck still has a teak thickness of about 7 to 8mm which is more than the teak layer installed on many new yachts.

Recommendation

(Cat 3) Replacing the teak decking would be a considerable undertaking. A practical alternative would be to re-furbish the existing deck. All the old caulking must be removed. The planks that are lifting must be replaced and it is also recommended that other planks that have not been made from quarter sawn stock should also be replaced. It may be necessary to re-rout some of the caulking grooves as they should ideally be at least as deep as they are wide. The deck should then be re-caulked and faired back.

Many of the dowel plugs will be lost in this process exposing the screws. These can be removed and the holes carefully counterbored deeper and the screws replaced and dowelled over. Always add some caulking to the screw thread when re-fitting as it could be a route for water to get into the cored deck.

The hull moulding continues upward to form a low bulwark which is capped with teak. The teak capping has been made in sections with scarfed joints which have opened up in places amidships. There is no rubbing band and the bulwark capping is therefore vulnerable to knocks.

Recommendation

(Cat 3) repair the teak bulwark capping. Due to the damage occurring at a joint and the contamination in the timber and lost material, it will be necessary to remove a short section under the Genoa sheet track and make new with 6:1 double scarfed joints. As this is in the maximum beam where the curve is at its greatest it is unlikely that the section can be sprung to the bulwark without putting too much stress on the new joints. It is recommended that the repair section is kept as short as possible and sawn to shape.

f) Superstructure

The coachroof is constructed of mahogany and mahogany faced plywood. The forward end of the coachroof has a rounded profile which has been cold moulded from mahogany veneers and incorporated into the joinery. The cabin top is in mahogany faced plywood and laid onto cambered beams laminated from alternating mahogany and ash. The coachroof is then laid with a teak deck with teak margins and polysulphide or polyurethane type caulking.

The coachroof is well made and sound with no signs of failure of the varnish coating or water staining of the timber. The coachroof top is inlaid with teak planking and suffers from the same erosion as the deck. Treatment of this area is more problematic than the deck because the teak planks are inset. The mahogany coachroof sides are rolled over at the top and are flush with the teak deck. Any fairing back of the deck would also involve fairing back of the mahogany which is cold moulded from veneers.

The coachroof top is a relatively small part of the total teak decking and is highly visible. It would benefit from having the teak planks replaced entirely. Only the part forward of the coaming would need replacing as the teak planking on the coachroof aft of the coaming is in good condition. It appears that this section had been protected from weathering by the spray hood and therefore had not been aggressively cleaned.

Recommendation

(Cat 3) Replace the teak planking on the forward part of the coachroof.

The mast step seated on the coachroof is a teak strongback which spans the bulkheads below and spreads the compressive load of the mast and rig tension through the bulkheads to the hull. It too has had the surface eroded by aggressive cleaning but it is a substantial solid piece of timber and would take a fairing back. Moulded teak handrails are fitted to the coachroof and are in reasonable condition and felt secure.

There are also two dorade type ventilators mounted on the coach roof which were in good condition with no signs of leaking down below.

g) Hatches & Companionways

The main companionway is closed by a sliding hatch fabricated from solid mahogany and mahogany veneered plywood running in a hatch garage. The hatch moves easily on bronze runners. There is a pair of hinging companionway doors fabricated in mahogany and mahogany ply on lift off hinges .

There is a mahogany constructed removable storm board below ,which brings the companionway sill up to deck level. This storm board is not tethered and is easily dislodged. The doors are secured by a quarter turn latch and there is no other means to lock the companionway. Generally all is in good serviceable condition and the varnish is well adhered

Recommendation

(Cat 1) It is recommended that the storm board be fitted with a retaining method to prevent it being dislodged and lost overboard in a seaway. This can be just a short lanyard attached to the board and passing through a cam cleat with a fairlead. Alternatively is could be secured with barrel bolts.

(Cat 1) Some form of locking arrangement should be provided for the main companionway hatch. This should be of the type that can be operated from both outside the accommodation and from within, and retains the lift off companionway doors when secured.

Forward of the mast in the coachroof is an opening hatch fabricated in solid mahogany and mahogany faced plywood. The hatch is hinged on the forward edge and had friction type struts and a secure lock. All are in good condition.

h) Windows and portlights

There are four rectangular windows, non-opening, on each side of the coachroof. Glazing is of toughened glass and the glass is bedded into rebates in the mahogany coachroof sides and secured with stainless steel bezels with screws. The glass is clean and the frames in good condition. There is no sign of leakage or water tracks on the inside. The varnish along the bottom edge of some of the windows has slightly peeled but this is probably due to condensation rather than leaks.

i) Deck gear and fittings

Chain plate fittings for cap shrouds and fore and aft lowers are ‘U’ bolts fastened through the hull to deck joint inside the bulwarks. The bolt size is 10mm and the backing plates are 2mm stainless plates 5mm oversize of the threads. The chain plates are not tied to any other structure within the vessel. There are clear signs of rusting and rusty water streaks on the underside of the deck emanating from the bolt threads.

Any evidence of hidden corrosion in load bearing stainless steel components must be addressed as a matter of urgency. *(See explanatory note 6)*

Recommendation

(Cat 1) Remove the 'U' bolts and replace with A4 stainless 'U' bolts which are more resistant to pitting corrosion. Larger backing plates should be made of minimum 3mm stainless plate to help spread the load and prevent crushing of the GRP. This will limit the potential for movement and therefore for water ingress into the fitting which would initiate pitting corrosion

On the foredeck on a mahogany plinth stands a cast aluminium alloy bollard. This is lightly oxidised but in good serviceable condition. It is well seated and secure although it is only fastened through the deck moulding and not to any underlying structure.

On the bulwarks amidships are genoa sheet tracks in a stainless steel 'T' profile with aluminium alloy cars and stand up blocks with nylon sheaves. All are well secured and are in serviceable condition. There are no signs of flat spots wearing on the sheaves which would be expected if original in a vessel of this age. A pair of mooring cleats is also mounted on the sheet track and is secure.

Additional mooring cleats are mounted in pairs at the bows and on the quarters with sunken fairleads in the bulwarks. They are all in aluminium alloy and are secure and serviceable.

Primary winches mounted on the cockpit coamings are 2 speed Lewmar 30st self tailers and are relatively new and in good condition. The spinnaker sheet winches are single speed Lewmar 16's. These are old model Lewmar winches and the numbering system has been changed so there is no comparable dimensional reference in the sizes of the two types of winches fitted. The old style Lewmar 16 is almost the same drum size at the modern 30 but of a lower profile. None of the winches were able to be tested under load.

The teak cappings to the coamings on which the winches are mounted are supported on stainless steel struts to the deck. These are structurally sound but the fastenings need renewing.

Recommendation

(Cat 2) Renew the fastenings for the sheet winch struts.

A main sheet track in a stainless steel 'T' profile with an aluminium alloy car and stand up block with nylon sheaves spans the cockpit just forward of the steering space. This was in good condition for its age and quite serviceable.

j) Safety equipment

The vessel is equipped with tubular stainless steel pulpit and pushpit with 4mm 7 x 19 stainless steel guardwires with roll swaged end fittings and rigging screws for tensioning. There are three stainless steel stanchions each side socketed into stanchion bases bolted through the deck. At first sight it appears that there is one stanchion missing from each side in way of the shroud base. Closer inspection revealed that the guard wires just stretch round the cap shrouds and that there is no stanchion to secure them at that point, the cap shroud has leather bindings to prevent chafe where the guard wires contact the shrouds.

This leaves a section of guard wire almost 4 metres in length with no vertical location to prevent the wires from parting sufficiently to allow a crew member to slip through. Also it means that when the mast is unstepped, the guardwires go completely slack which can prove dangerous when working on the vessel if laid up ashore.

As the mast was unstepped there was no cap shroud to tension the guardwires so it was impossible to check whether there was sufficient scope for adjustment left in the rigging screws to tension the wires adequately.

Recommendation

(Cat 2) It would be considered advisory to fit a fourth stanchion in way of the shrouds to maintain tension and locate the guardwires safely in the vertical plane.

The stanchion bases were all, to varying degrees, loose in the deck. The fitting of the stanchion bases appears to be two threads stud welded to the underside of the base plate. One thread is directly under the stanchion and the other is approximately 3cms inboard. When stressed the first acts as a pivot whilst the inboard stud takes the load. Stud welding is neat looking as there is no visible fastener or weld pool on the upper face of the base plate, but it is not very strong as the contact area is very small and the weld has little penetration as the process is similar to spot welding.

A 60cm high stanchion can apply a significant leverage and thus the inboard studs on some of the stanchions have sheared off. Not all the stanchion base studs could be tested as there was limited access under the deck. The ones that could be tested showed that there was no movement in the inboard studs when the bases were rocked back and forth.

Recommendation

(Cat 1) All stanchion bases should be removed and replaced. Bases similar to those currently fitted are available but with three countersunk holes for

securing through bolts. These should be fitted with substantial backing plates to prevent movement.

There are webbing jackstays fitted which are in good condition and there is one large lifeline hooking point in the cockpit which is within reach of the companionway. Two brackets for horseshoe lifebuoys are fitted to the pushpit rail.

k) Skin fittings & seacocks

Note; Bronze is conventionally an alloy of copper and tin, but the term is popularly used to describe a wider range of copper based alloys. There is no non-destructive test for alloy composition which is practical within the scope of this survey. Where visible casting marks indicate a particular alloy, it will be described, otherwise the term 'bronze' is used in this report to denote a copper based alloy of indeterminate composition. *(See explanatory note 7)*

The vessel has a self draining cockpit and the cockpit drains are crossed over and exit via bronze elbow and bronze ball valves near the after edge of the keel. Both ball valves were very stiff to operate probably due to lack of use. Ball valves cannot be lubricated or serviced but usually free up through regular use. The skin fittings are of bronze and were rung soundly with a pin hammer. The surfaces were cleaned up and were found to be of a good bronze colour.

Where de-zincification has caused the leaching of zinc out of the alloy the metal surface turns a pink orange colour commonly referred to as 'carroty'. The hoses are in PVC with spiral wound wire reinforcement each fitted with a single stainless steel worm drive hose clip, all in good condition.

The toilet hull fittings were forward of the keel. Both inlet and outlet were bronze ball valves and are free to turn. The skin fittings are of bronze and were rung soundly and of good colour. The hoses are white sanitation hose with PVC reinforcement, each fitted with a single stainless steel worm drive hose clip.

The engine cooling water intake valve is a backward facing grille type in bronze with a 'Stuart Turner' type combined ball valve and seawater strainer. The valve turned smoothly and the clear PVC hose with nylon mesh reinforcement is double clipped with stainless steel worm drive hose clips. The skin fitting rung well and is of good colour. This seacock located under the cockpit floor is in a very poor location, unsuited to easy access. As it is in the engine compartment, in the event of an engine fire it would be very difficult to shut it off.

Recommendation

(Cat 1) It is recommended for fire safety to fit a remote operating cable to the engine cooling water intake valve. There are proprietary kits available for this. Alternatively fire resistant hose, fuel hose A1 or A2 to ISO 7840, could be used for the connection to the engine water pump.

There are two sink drains on the starboard side. One for the galley sink which has a bronze gate valve, and one for the heads compartment basin with a bronze ball valve, both operated smoothly. The skin fittings are of bronze and were rung soundly and of good colour. The hoses are of clear PVC hose with nylon mesh reinforcement were each fitted with a single stainless steel worm drive hose clip.

Recommendation

(Cat 1) All hoses bar the engine cooling water intake hose have only one hose clip. It is recommended that all hoses on below waterline hull openings should be double clipped. Before fitting it must be established that the hose tails are long enough to accommodate them safely, if the hose tails are too short a second clip can actually force the hose to become detached.

There is also a through hull fitting for a log impeller which is in a glass filled nylon and is in good condition.

Recommendation

(Cat 1)There should also be wooden bungs of a suitable size securely located besides each skin fitting. These can be secured by a short lanyard to the skin fitting.

Electrical continuity between the bronze skin fittings and the single hull anode was tested with a multimeter. No continuity was found and internal inspection showed no bonding system was installed, which is good. It could have been expected that this vessel would have a bonding system installed for all skin fittings as was the norm in the 1970's. It was subsequently found to be counterproductive and is not now considered best practice. *(See explanatory note 8)*

Above waterline, the engine exhaust outlet is under the transom on the starboard side and is a chromed bronze fitting. It is of a poor appearance but is sound.

The bilge pump exits in a similar position on the port side. The hose is in PVC with spiral wound wire reinforcement and the skin fitting is of bronze and was rung soundly and of good colour.

The anchor locker drains overboard through a skin fitting on the starboard bow above the waterline. The hose is in PVC with spiral wound wire

reinforcement. The skin fitting is of bronze and was rung soundly and of good colour.

The Eberspacher heater exhaust is a stainless steel fitting in the port transom. The exhaust hose is in convoluted aluminium with glass fibre exhaust wrap and is in good condition.

The gas locker vents through a plastic skin fitting approximately 150mm above the waterline in the starboard topsides adjacent to the locker. The hose is in PVC with nylon mesh reinforcement and secured with a single worm drive hose clip. It is a recent installation and in good condition.

The side decks scuppers are flush drains which drain through ducts moulded to the hull sides and exit each side through opening at the waterline.

l) Engine

The engine is a 1995 Volvo 2020 18hp three cylinder diesel with a Hurth reduction gearbox. The engine is freshwater cooled with a heat exchanger. Raw seawater is pumped via an engine driven pump through a combined water cooled exhaust manifold and heat exchanger and injected into the exhaust elbow. The fresh water is circulated by an integral water pump through the block and head and heat exchanger. There is a header tank mounted in the starboard cockpit locker which is well secured and of sufficient height above the heat exchanger to function effectively.

The engine sits on cushioned engine mounts fitted to moulded solid beds. The engine mounts are quite rusty but the rubbers were good. The engine was in good overall paint condition but there was considerable rusting starting on the water injection exhaust elbow below where the water hose fits the heat exchanger. This connection is obviously leaking hot salt water onto the exhaust elbow. Also water is obviously leaking from the impeller pump cover as there is salt staining on the pump.

Recommendation

(Cat 1) The water leaks in the raw water outlet at the heat exchanger must be sealed. The water injection exhaust elbow is a vulnerable component that frequently corrodes from the inside and is expensive to replace. Any additional corrosion on the outside will considerably reduce its service life. The exhaust elbow casting must be cleaned up and a suitable rust conversion treatment applied and re-painted. Also the leak from the raw water pump must be sealed with a new paper gasket and the gasket sealed with the grease that is supplied with a new impeller.

The exhaust is fed to a Vetus waterlock. This unit sits at an angle of 45° on the hull side. These units are designed to work properly when mounted flat on its base. If the yacht was heeling on starboard tack the waterlock would be on its side and would fail to work. The input fitting would be below the water level

in the waterlock and if the hot engine cooled it could draw water back into the engine and caused a hydraulic lock. After the water lock the Vetus exhaust hose runs to a suitable swan neck and a silencer before exiting under the transom. All looked to be in satisfactory condition.

Recommendation

(Cat 2) The waterlock must be re-located so that it can sit horizontally on its own base. This may be difficult given the hull shape and the location of the propeller shaft but it must be sited so that the input flange is below the level of the exhaust elbow.

The engine could not be run, but the oil was checked and was free of particulates and emulsification, also the gearbox oil was clean. Belt condition and tensions were good and engine control levers operated cleanly. There is a single lever engine control in the cockpit on the starboard side which operated properly.

The engine instrument panel is mounted in the cockpit on the port side and is protected by an acrylic panel. The operations could not be tested. There is an engine pull stop lever just aft on the panel and it was stiff to operate but worked. There are no de-compressors or starting handle on these engines.

m) Fuel system

The fuel tank is of an all welded stainless steel construction and is located under the base of the starboard cockpit locker. It is filled by a skin fitting in the adjacent side deck. Access to the tank is prevented by the installation of a gas locker immediately above. I understand that this is a relatively new addition. Ideally stainless steel tanks should be mounted on welded flanges so that no fuel retaining surfaces are used for mounting where moisture can be trapped. This can lead to pitting corrosion. Regular checks should be made for signs of weeping of fuel if the tank is mounted directly on bearers.

Recommendation

(Cat 2) The boards of the base to the locker should be modified to enable visual access to the fuel tank and for regular checks for leakage to be made. When done, checks should be made for the method of mounting of the tank.

The fuel filler hose is of nylon fibre spiral reinforced PVC. This material is not approved for the use as fuel filler hose on vessels. As the tank and filler are not in a location accessible to the engine space, the filler hose should be B1 or B2 fuel hose to ISO 7840

Recommendation

(Cat 1) Replace filler hose with B1 or B2 fuel hose to ISO 7840.

Due to access difficulties it was necessary to remotely view the tank installation. A Ridgid Micro CA100 endoscopic camera was used to investigate the tank installation further. It was found that the Eberspacher heater was almost certainly a retrofit item and the fuel feeds for the heater was via a 'T' fitting off the same siphon tube as the engine fuel from the tank. The fuel shut off valve in Eberspacher heaters have been proved in other installations, to be inadequate to resist the vacuum created in the fuel line when the fuel pump draws from a tank mounted below or beside the engine. This can lead to air locks forming in the fuel supply which will stop the engine when drawn into the injector pump.

Recommendation

(Cat 2) Install separate fuel feed siphon tube for the Eberspacher. Alternatively fit a solenoid fuel valve in the heater fuel line switched via the heater switch panel. This needs to be fitted 'backwards' so that it shuts off the fuel flow away from the heater when closed. Eberspacher heaters draw about 20 amps on start up so the switch rating should be sufficient for the additional 1 amp approx load.

The fuel is fed via copper tubing to the fuel filter and water separator mounted in the engine space on the starboard side. The separator had a quantity of water in the bottom and needed draining. All fuel hoses in the engine space after the filter were of approved type. There is a fuel shut off tap in the fuel line prior to the filter

Recommendation

(Cat 2) Drain the fuel filter water trap. It is further recommended that diesel fuel tanks are kept full where possible, particularly in the lay-up season to minimise condensation inside the tank which is the primary cause of water contamination.

n) Stern gear

The gear box output flange is bolted to a conventional clamp type coupling fitted to a 1 inch stainless steel propeller shaft. The coupling is superficially rusty but appeared to be reasonably well aligned as the engine did not move on its beds when the shaft was turned. The shaft is sealed in a conventional stuffing box type stern gland which is greased via a screw greaser in the lazarette which all looked in good working condition, the greaser handle turned easily for a couple of turns then came up tight as it filled the gland . It could not be checked for leaks as the vessel is out of the water, but there are no obvious tracks of water below the gland. The shaft was tested with a magnet and appeared to be a good quality stainless steel.

Externally the shaft exits in a cutlass bearing which is in good condition with negligible slack. The bearing is lubricated by water fed from a forward facing port in the side of the shaft log. The shaft swings a fixed, three bladed bronze propeller on which the diameter and pitch marks could not be read. The

propeller rung soundly is of good colour and looks to have been recently replaced. The castellated bronze propeller nut was seized with a split pin and was in a good sound condition.

Continuity between the propeller and prop shaft assembly and the hull mounted anode was tested with a multimeter and found to be adequate at less than 1 ohm resistance.

o) Steering system

The rudder is a clam shell GRP moulding which is probably foam filled with a stainless rudder stock and welded tangs. Measured with a Tramex Skipper Plus moisture meter it is considered wet at over 60 on the deep scale and 18 on the shallow scale. This reading is probably water in the foam core as there is no evidence of blistering. There are no signs of splitting where the clam shell mouldings are bonded together.

This is not unusual for a rudder of this type of construction where the stainless steel stock to the GRP blade joint is below the waterline. It is almost impossible to prevent the joint from leaking water into the core of the rudder, particularly in this instant where the stock exits the blade again to form a pin which engages in a gudgeon above the propeller aperture. The blade at the bottom has a pin which pivots on a heel block on the after end of the keel. There is considerable slack in this bearing but it is unlikely to disengage as the rudder is well located.

Recommendation

(Cat 2) The heel block should be removed and the pin re-profiled and the hole in the heel block sleeved to close up the clearance over the rudder pin.

At the extremes of travel the rudder fouls on the fairing in after end of the keel. This results in the antifouling being scuffed off. Considering the leverage that can be applied at this point, it is likely that eventually the hull fairing will get damaged.

Recommendation

(Cat 2).It is unsatisfactory that the limits of travel for the rudder stock and blade are made by the rudder fouling on the hull. Consider installing rudder stops to the top of the stock.

The rudder stock passes through a continuous rudder tube with white plastic bearings in either nylon or acetal; it was not possible to determine which. The stock exits in the afterdeck where the stock end is milled to a square. The lifting tiller hinges on a bronze block which clamps to the squared block. The bearings in the tube are also a bit slack but quite serviceable. Nylon is slightly hydroscopic so will take up when immersed. As this vessel has been out of the water for some time the slack in the bearings will most likely disappear in service. The bronze block and tiller are in good condition

Recommendation

(Cat 2) Regular checks should be made of the security of the rudder stock in the blade. The stock will have stainless steel tangs welded to it which extend into the core of the rudder. If the welds are subject to crevice corrosion or hydrogen embrittlement due to the wet core, the welds could fail and steerage will be lost.

p) Mast spars and rigging

The mast was unstepped and slung from rafters above the vessel so that a good examination could be made. It is silver anodised one piece aluminium extruded single spreader spar by Selden

The mast is in good overall condition with no damage to the anodising. The spreader fittings are secure with no loose rivets

The gooseneck fitting is secure with no sign of movement in the rivets and free of corrosion. As the boom is detached it could not be established if there was excessive wear or movement in the gooseneck. The mast cap is an alloy casting socketed into and bolted through the mast. It carries the halyard sheaves and all is in good condition with no flat spots on the nylon sheaves. The mast foot is a casting with sheaves for the halyard exits. All the sheaves turn well with no flat spots.

A pair of old style Lewmar 7 single speed winches are fitted on angled riveted on plates either side of the mast as halyard winches. There is a single Lewmar 6 mounted on an angled riveted plate on the aft face as a reefing winch. All the winches are in good working order but not tested under load. There was no evidence of movement or corrosion in the mountings.

The boom is also manufactured by Selden. It carries reefing lines inside with sheaves at the outer end and jammers at the gooseneck. All the fittings are in serviceable condition and no corrosion is evident.

The spinnaker pole is manufactured by Sailspar and is relatively new and in good condition.

The rig is a masthead sloop with twin forestays, cap shrouds, fore and aft lowers and a backstay on a bridle stayed on the aft quarters. A Selden Furlex roller furling gear is installed on one forestay. The extruded headstay foil is a three piece extrusion connected by spigots and grub screws. At the uppermost joint the extrusions have started to part and a gap of about 5mm has appeared. This is not a structural problem as the foil takes no load, but it is a potential to damage the luff rope.

Recommendation

(Cat 2) Close up the gap in the headstay foil. If the grub screws have formed a slot in the spigot it may be necessary to renew it. It would also be prudent to investigate why the joint has been pulled apart. It may be that the swivel or the bolt rope is jamming in the top section

The rigging is all in 7mm 1x19 stainless steel wire with roll swaged terminals and open bodied chrome plated bronze rigging screws. The shrouds terminate at the mast with roll swaged 'T' fittings which engage in slots cut in the mast. These slots can enlarge with use, but these are in good condition. All terminations were available for examination except the 'T' fittings which could not be articulated sufficiently to disengage them from the mast fittings, and the lower forestay fitting which is encased by the Furlex.

The roll swages were examined for signs of splitting, evidence of corrosion and signs that the wire is drawing out of the swage. All were seen to be good. It is understood that the rig was new in 2003. It is usually required by insurances companies that cruising rigs are replaced after 10 years.

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q) Sails and running rigging

None of the sails were available on board for inspection. Running rigging is all in double braid Terylene. There were no signs of chafe in the visible sections. The ends had been sealed by heat fusing with no signs of separation between core and sleeve.

r) Sea toilet

The sea toilet is a Baby Blake and is in good condition. This is a very high quality unit and a full set of spares is readily available. The hoses, detailed elsewhere, were in serviceable condition with an adequate swan neck and anti-siphon valves fitted. The inlet hose seacock is located outside the heads compartment which may prove inconvenient in use. A second ball valve has been fitted in the line which is situated inside the compartment, presumably to cure this problem. Valves and skin fittings are detailed elsewhere.

A pull out basin is fitted above the heads with a flexible hose running to the discharge valve. Fresh water is supplied to a faucet by a foot operated pump fitted in the forward bulkhead. The runners of the pull out basin still run well and the basin is quite serviceable.

s) Fresh water system

The fresh water tank is moulded into the sump of the keel. It has a stainless steel inspection hatch to which the filler pipe and the vent are fitted. Also fitted are the PVC outlet pipes, one going forward to the heads basin and one going aft to the galley. The tank is of 120 litres and rather small capacity for the

number of berths on the vessel. The filler hose is in black laminated PVC and nitrile rubber and runs from a flush deck filler in the port aft side deck. It runs under the engine sump between the engine beds and the hose has been de-laminated by the radiant heat of the engine.

Recommendation

(Cat 2) Renew the fresh water filler pipe. Consider re-routing the pipe outside the engine space or insulate from heat damage.

t) Galley

The galley is inside the companionway on the starboard side. It has a small sink with a single manual water pump. Surrounded by a small work surface, there is a Taylor's gas cooker installed on gimbals. It has twin burners, a grill and an oven. There are flame failure devices on all burners. It also has a fiddle rail with pan clamps. The cooker was not tested but all looked to be in good order. The cooker was new in 1996. The gas is supplied via a stainless steel braided rubber hose detailed elsewhere.

There is storage to rear in sliding door lockers and additional work surface is provided by sliding a cover over the cooker. There is a stainless steel lined coolbox, all was in a good functional condition, but the sliding doors can be too easily detached by inadvertently lifting from the bottom channel.

u) Electrical system

Two sealed type lead acid deep cycle leisure batteries are located under the bottom boards of the port cockpit locker. They are securely strapped down and should stay in position in the event of inversion. A battery isolator switch is installed by the chart table on the port side of the accommodation. It is a four position switch which switches each battery in line and bus tie for emergency engine starting. The switch turned efficiently but the batteries needed fully charging for some systems to be tested. Charging is from an engine mounted 55 amp alternator. Alternate charging sources are an Aerogen wind generator mounted on the pushpit and a solar panel on the hatch garage. Neither could be tested due to the location of the vessel under cover. There was no AC or shore power system installed.

DC circuits are supplied from two x 6 switch panels beside the chart table. All the switches are individually fused and labelled and operated satisfactorily.

The main cabin lights are incandescent lights mounted on the bulkheads fore and aft, and a fluorescent light over the galley. The chart table is equipped with a white light and a red light for night time navigation. All worked satisfactorily.

A fluorescent light is installed in the heads and worked satisfactorily.

The fore peak lights are incandescent lights mounted on the after bulkhead and worked satisfactorily.

The vessel is equipped with two sets of navigation lights, one set are good quality stainless steel bodied Aquasignal Series 50 units which are pulpit/pushpit mounted which tested satisfactorily. The second set is a stacked type masthead tricolour and anchor light, and a mast mounted steaming light, none of which could not be tested.

The wiring through the vessel is generally tidy and well secured. Behind the engine panel in the cockpit locker is loose wiring exposed to damage from gear in the locker.

Recommendation

(Cat 2) A box should be installed over the back of engine control panel to protect the wiring and the instruments form damage.

v) Gas system

The gas system is supplied from a gas locker situated within the starboard cockpit locker and containing one 4.5kg gas cylinder and a second spare of the same size. It is understood from the owner that this installation was new 3 years ago and has been certified by a registered gas installer, but no certificate was found on board. The locker appears not to have a lid or any means of securing a lid. A gas locker situated within another compartment should have a lid to prevent items stored within the compartment damaging the regulators or hoses. It is also recommended that the locker should have a vent in the top equal to, or of greater size than the drain in the bottom to ensure an air circulation to enable any leaked gas to escape.

The flexible hose from the regulator is dated 03/08. The gas supply from the locker is in copper with bulkhead fittings terminating at a shut off valve by the cooker and a newer 07/10 flexible armoured hose to the cooker. The pressure regulator is undated but is assumed to have been new when the locker was installed. There is no other gas appliance on the vessel. *(See explanatory note 9)*

Recommendation

(Cat 1) Fit a lid closing down on neoprene seals with a secure fixing arrangement to the gas locker. Install a vent hose from the lid to a skin fitting outside the vessel , all hose and fittings to have a minimum 12mm ID.

(Cat 1) Replace gas locker hose with hose to BS3212 type2.

w) Fire fighting equipment

A powder fire extinguisher of 1kg is stowed on a bracket above the galley. The pressure was correct but there was no dated service record. This was the

only extinguisher found on the vessel and it was not accessible from the cockpit. A fire blanket was also located in the galley area. The engine compartment cover had a bunged extinguisher hole. Powder extinguishers can cause accelerated corrosion damage engines if used whilst engine is running. *(See explanatory note 10)*

Recommendation

(Cat 1) At least one fire extinguisher must be mounted so that it can be accessed from outside of the accommodation. Also recommended is that the main saloon extinguisher should be a 2kg unit to 13A 70B on this size of vessel and a 1kg 5A 34B unit be installed in the forepeak.

x) Bilge pumping

There is one manual single acting bilge pump mounted in the cockpit locker. It pumps from a strum box in a sump in the keel moulding. Without water in the bilge it was impossible to test it adequately.

Recommendation

(Cat 1) The manual pump must be tested as soon as the vessel is re-launched. The rubber choker valves in the pump can dry out and become inflexible without water present and cease to operate. If the pump does not work satisfactorily it must be replaced.

(Cat 1) A second bilge pump must be fitted. This could be a 12v electric centrifugal type pump mounted in the keel sump. It should discharge through a separate skin fitting installed in the topsides. Care must be taken to select a pump capable of a reasonable delivery at an elevated head as the vertical height from the bottom of the sump to the topsides on this vessel is about 2 metres. If an automatic pump is fitted it must have a non-return valve in the hose as the small capacity of the sump will result in constant cycling, it should be of the ball type as the nitrile flap type can prevent a centrifugal pump from priming.

y) Interior fit-out

The fit out has been executed in solid mahogany in the main with mahogany veneered plywood. The layout is traditional for the period with a V berth forward, a heads compartment and hanging locker opposite amidships and two settee berths either side of a saloon table. Aft of the saloon are a galley to starboard of the companionway and a navigation station to port. The navigation station has a half Admiralty Chart sized table with a lifting lid and cove lockers behind and drawers beneath. There is no seat for the navigator; this is provided by sitting on the engine cover. The upholstery was in blue velour and in good condition. The joinery is in a satin burnished finish and in very good condition for its age.

The two saloon berths have cove lockers behind and cupboards with latching closures above. Beneath the berths are further cupboards with latching closures. These provide ample stowage. All berths are fitted with lee cloths.

The saloon berth seat backs can be hinged up and secured to hand rails in the coachroof head to provide for a wider berth for sleeping. In the forepeak are shelves against the hull sides and one forward behind the anchor locker moulding.

z) Additional equipment

A Sestrel binnacle compass in the cockpit is in good condition, the lens is clear but the fluid level is low.

A full suite of Brookes and Gatehouse instruments mounted on the hatch garage. These are a dated model which is no longer supported by the manufacturer. They could not be tested.

Icom M601 DSC VHF transceiver which could not be tested

MLR GPS receiver which could not be tested

B&G Hornet repeater for the cockpit instruments which could not be tested

A gas alarm by the chart table with a sniffer in the bilge which could not be tested

A ‘Standard’ Hand held VHF which could not be tested

A quantity of warps and fenders in useable condition

An Avon inflatable boat with oars and thwart seat. This was deflated and could not be tested

Aerogen wind generator and charge regulator for same fitted, Untested

10 Watt flexible solar panel, untested

Horseshoe lifebuoy and floating light, light was not working when inverted.

Boarding ladder on transom, good condition

Aries Mk1 Wind vane steering gear, untested but in good apparent order

Rod kicker, untested

Danforth Anchor with 30 m chain and 30 m warp. Fair with some rusting

Bruce kedge anchor with 5m chain & warp. Good condition but length of chain is insufficient for a proper catenary for the anchor to hold in a strong tide

Spray hood and cockpit cover. Good condition

Full winter cover, unchecked

Boat hooks, good condition

FM Radio CD player and speakers, untested

A pair of paraffin lamps on gimballed hangers, untested

Recommendations

(Cat 1) Repair or replace bulb or batteries to floating light

(Cat 2) Add a further 5 metres of chain to kedge anchor chain.

Summary of recommendations

Full details can be found in the body of the report

Category 1 recommendations are safety related defects which must be corrected before the vessel is put into commission.

(Cat 1) Replace the sacrificial anode.
(Cat 1) The storm board be fitted should be fitted with a means of securing.
(Cat 1) A locking arrangement should be provided for the main hatch.
(Cat 1) Replace the chain plate 'U' bolts.
(Cat 1) All stanchion bases should be removed and replaced.
(Cat 1) Fit a remote operation or fire resistant hose to engine water intake.
(Cat 1) Double clip all below waterline hoses.
(Cat 1) Install wooden bungs of a suitable size to below waterline skin fittings.
(Cat 1) Replace filler hose with B1 or B2 fuel hose to ISO 7840.
(Cat 1) Fit a lid to the gas locker and install a vent.
(Cat 1) Replace gas locker hose with hose to BS3212 type2.
(Cat 1) Upgrade fire fighting equipment.
(Cat 1) Install a second bilge pump.
(Cat 1) Repair or replace bulb or batteries to floating light

Category 2 recommendations relate to defects which affect the operation of the vessel in normal use and should be attended to at the earliest opportunity.

(Cat 2) Re-test the hull for moisture readings when next lifted.
(Cat 2) Repair the damage to the gel coat on the port and starboard bows.
(Cat 2) Renew the fastenings for the sheet winch struts.
(Cat 2) Fit a fourth stanchion in way of the cap shrouds.
(Cat 2) Fix the water leaks in the raw water outlet at the heat exchanger.
(Cat 2) The waterlock must be re-located so that it can sit horizontally.
(Cat 2) Modify the boards of the base to the locker to give access to fuel tank.
(Cat 2) Install separate fuel feed siphon tube for the Eberspacher.
(Cat 2) Drain the fuel filter water trap.
(Cat 2).Fit stops to limit travel of the rudder stock.
(Cat 2) Remove and modify the heel block.
(Cat 2) *Regular check should be made of security of the rudder stock in blade.*
(Cat 2) Renew the fresh water filler pipe and protect from heat.
(Cat 2) A box should be installed over the back of engine control panel.
(Cat 2) Close up the gap in the headstay foil.
(Cat 2) Add a further 5 metres of chain to kedge anchor chain.

Category 3 recommendations relate to conditions which are cosmetic or affect the value of the vessel and should be attended to in the next lay-up season.

(Cat 3) Protect the topsides gel coat with PTFE polish.
(Cat 3) Refurbish the teak decking.
(Cat 3) repair the teak bulwark capping.
(Cat 3) Replace the teak planking on the forward part of the coachroof.

Conclusions

'Swedish Lass' is a well known and regarded local boat having been owned and sailed on the Essex Rivers all her life. The present owner is believed to be her fifth owner.

This Vindo 32 is in generally good overall condition considering that she is now some 33 years old. This is very much down to the original build quality for which Swedish yards are renowned for the world over. Many of the recommendations given relate to current custom and practice which were not in place when this vessel was built. There are a number of idiosyncratic features to the design of this vessel which have not been adopted by other boat builders and make it unusual.

This particular example of the class has benefitted from some considerable investment in high quality fittings and equipment and has generally been well looked after. The mahogany accommodation fit out and the coachroof are in particularly good condition for her age.

The teak deck is a problem which needs a very considered solution. The cost of re-laying the whole deck by a skilled shipwright would be a very significant proportion of the value of the vessel. For this reason giving a value to this boat in its current condition is very difficult.

The vessel has the benefit of recently upgraded sails, engine, upholstery and rigging, and also a recent very high quality sea toilet and cooker with a new gas system. Taking these factors together with the good condition of the rest of the vessel, were the teak deck to be re-furbished or replaced the vessel would command a price at the upper end of the market for her type.

A valuation is enclosed under separate cover for confidentiality.

Richard Thomas BA(hons) MRINA

29/08/2012

Appendix: Explanatory Notes

These notes do not form part of the survey report. They are given with the intention of providing contextual information to the recommendations given

1) **Osmosis.** There are three distinct stages in the process whereby water absorbsion into the laminate can lead to blistering. It is important to recognise that there is no automatic assumption that each stage will lead to the next, as other factors need to be present.

   Firstly all polyester resins will absorb some water without any detrimental effects. Styrene is added to polyester resin to thin it and make it easier to work, it is also essential to the polymerisation of the resin. In the curing process not all the styrene will be used by the polymerisation of the resin, and the remainder will evaporate off over time resulting in the characteristic new boat smell. This evaporation will leave microscopic permeations in the resin which will absorb water. The presence of small levels of moisture is therefore normal and is not a cause for concern.

   The second stage is an osmotic reaction; it is necessary for trapped pockets of uncatalysed water soluble molecules of ethylene glycol or neopentyl glycol from the base resin or MEK from the catalyst to be present in the laminate, and for the absorbed water to mix with them and produce an acidic solution. Osmosis is the process whereby a permeable membrane will attempt to balance the acidity of the solutions across it. Water will be drawn under pressure from the alkaline side (seawater) to the acid side, drawing water into the laminate. Eventually the pressure in the pocket can reach a point where it is equal to the osmotic pressure and it will reach a stasis. The inherent strength of a well consolidated glass laminate fully wetted with properly catalysed resins will be able to contain this pressure without being affected. Provided a vessel is hauled out and laid up regularly, a vessel can suffer an osmotic reaction without any visible evidence other than elevated moisture readings immediately after hauling which will rapidly drop off after a period ashore.

   Third stage is the formation of blisters; if the pockets are particularly large due to poorly consolidated laminates or the emulsion used to bind the glass fibres has not been fully wetted out because of the resin curing too rapidly, then the pressure can fracture the laminate and a fissure will form. Resin/fibre bonding failure can also be caused by water wicking along the fibres. Some manufacturing techniques used by boat builders over the years have proved to be very poor practise with the benefit of hindsight. Spray layups using a chopper gun and double gelcoats have both produced hulls very prone to blistering.

   If a fissure starts to form and expand, the pressure will not increase and this will allow osmosis to continue to take place. Physical evidence will appear in the form of blisters and generally the size and form of the blister represents how deep the blister is seated in the hull construction. Very small circular

bubble blisters of 2 to 5mm will probably be in the paint or epoxy coatings and will not be a cause for concern. They will be very likely to disappear after a few weeks out of the water. Domed blisters with defined edges between 5mm and 20mm will most probably lie in the interface between the gelcoat and the laminate or between the layers of a double gelcoat. For osmotic blisters to be present in the laminate itself they will usually be a minimum of 20mm in diameter and be irregularly shaped with undefined edges. The extent of these blisters will often be easier to trace by hammer testing than by sight.

2) **Gel repairs**. Trial batches must be mixed on a palette and catalysed and faired before colour matching can be finalised, as the colour will subtly change at both those stages. This mix must be applied to the repair area and built up in layers until proud of the surrounding surface. It can then be faired back to flush and polished. Do not use anything like colloidal silica to thicken the gel as the resultant faired in surface will be softer than the surrounding gel coat. This will result in the repair becoming visible when finished as it will not polish up to match the original.

3) **Gel protection** Wax-based products are widely used on gel coats but appear to give better protection than they actually do. Carnauba waxes provide protection from photo-oxidisation; however they give very limited protection from photo-initiation or UV attack. UV protection with carnauba wax begins to drop off in about 50 hours of exposure, with an almost total loss of protection after 250 hours.

   The best method for resisting UV attack is to apply a UV resistant surface coating. Silicone waxes are UV resistant but the problem with silicone compounds is that they tend to migrate. Because they are difficult to bond, they tend to move to adjacent surfaces and into porous materials such as the polyester gel coat film. This can cause serious problems with subsequent bonding in the event of the gel needing repair or refinishing. There is also the possibility that silicone migration can cause embrittlement of the gel coat.

4) **Teak plank erosion.** A tree's growth rings are made up of alternate bands of fast growing springwood and slower growing summerwood. The springwood is a wide band and is light in colour; it is relatively soft and has a thin walled cellular structure. Summerwood is a narrower, darker band and the cell structure is much stronger. It is these alternating coloured bands that create the attractive grain pattern in the face of the timber.

   The use of pressure washers or deck scrubbing has the affect of scouring out the soft springwood leaving the harder summerwood and the caulking as raised ridges. For this reason a teak deck should never by cleaned using a pressure washer or by aggressive scrubbing along the grain.

5) **Teak planks cupping.** Teak decking is traditionally quarter sawn in which the planks are sawn across the trees growth rings. This is because timber expands and contracts differently with moisture absorbsion. There is almost no movement along the grain which is why the butts rarely open up. There is some movement across the growth rings (radially) and much more along the

rings (tangentially). This difference between radial and tangential expansion and contraction is what leads to planks cupping. This will not happen if they are quarter sawn, as almost all the grain is run radially.

6) **Stainless steel corrosion.** Stainless steel is corrosion resistant by virtue of the chromium and nickel content in the alloy which rapidly oxidises and forms a coating of chromium oxide. This coating is transparent and impervious to oxygen and known as passivation. This effectively prevents further oxidisation. Stainless steel needs the constant presence of oxygen to remain corrosion resistant because should the passivation layer be damaged it needs oxygen to re-oxidise. Where stainless steel in encased in a material, particularly if there is high salinity present, pitting corrosion will occur. All corrosion is essentially electrochemical, with erosion of electrons from the anodic surface to the cathodic surface within an electrolyte or saltwater.

   Pitting corrosion is, as its name implies, deep pitting rather than the uniform surface corrosion found on mild steels. Any damage to the passivation layer becomes anodic, Due to the tiny size of the anodic pit compared to the surrounding metal which is cathodic, galvanic action results in highly concentrated aggressive erosion of the metal. This kind of corrosion is extremely insidious, as it causes just a small loss of material with little evidence on its surface, while it erodes deep into the structure of the metal. It can also lead to stress corrosion fracturing which is the propagation of cracks in a corrosive environment. This can cause the sudden failure of metals that are subjected to a tensile stress,

7) **Copper alloys**. Bronze is conventionally an alloy of copper and tin, but many other elements can be alloyed with it to produce particular properties needed for marine applications. Aluminium Bronze, Nickel Bronze, NIBRAL for propellers and stern gear. Silicone Bronze for screws and fasteners. Phosphor Bronze for springs etc.

   Brass is also an alloy of copper with the addition of zinc and is also widely used in marine applications. Naval Brass, Gunmetal and DZR Brass for valves and skin fittings. Manganese Bronze, sometimes called High Tensile Brass for propellers. Muntz Metal and Yellow Metal for tingles and sheathing. All these brasses have the addition of small amounts of other elements to aid corrosion resistance.

   Bronze is much stronger and more corrosion resistant than Brass. Bronze is harder and more abrasion resistant than Brass. But bronze alloys are four times the price of Brass, which makes a typical Nickel Bronze propeller between 30% to 40% more expensive than an identical Manganese Bronze (Brass) propeller.

   The exact composition of an alloy can only be established by an X Ray Fluorescent Spectrometer. There is no non-destructive test for alloy

composition which is practical within the scope of a survey. It is possible to identify Brass by the use of Hydrochloric acid which dissolves the zinc content producing a pink colour shift, but this is not technically non destructive. By creating a patch of copper rich alloy it effectively creates a cathodic surface surrounded by an anodic surface which will initiate and electrochemical erosion process.

8) **Cathodic protection of skin fittings.** It was common practice up to the 1980's to link all metal underwater fittings with a bonding connected to a hull anode. This was in the belief that any cathodic protection was better than none. In practice that proved to be counterproductive. In electrochemical erosion processes a current flowsbetween two metals which have a high potential difference (measured as a voltage) from the higher metal on the galvanic scale to the lower. Electrons flow in the opposite direction which results in a zinc anode eroding and depositing zinc on to the propeller which is the crust which is scraped off each year. For an anode to be effective it needs to be close to the component being protected as electrical currents want to take the shortest route. It is termed 'line of sight' in that the anode needs to be able to 'see' the propeller which is why anodes are located near the stern gear. If all the skin fittings are bonded to an anode, they are also bonded together. This means that there is a possibility of an electrochemical reaction between skin fittings which are of slightly differing alloys. Although their potential difference will much lower, they are likely to be very much closer to each other than to the anode. Best practice now is to ensure that skin fittings are electrically isolated within the vessel.

9) **Gas fittings.** Gas hose is assumed to have a service life and is dated with the month of its manufacture. It is safe practice to replace the hose after 5 years. Braided hose has the same assumed life span, as the rubber hose within is of the same specification and subject to the same progressive permeability as it degrades. The braiding is added to protect the hose from heat and abrasion damage and to resist kinking. It is also considered safe practice to replace gas pressure regulators after 10 years although this is not an industry standard. Some manufacturers stamp their units with an 'inspect or replace' date, usually 5 years from date of manufacture. Other manufacturers do not date their units at all, or use a date code which can only be read by their service departments.

10) **Fire extinguishers.** The best extinguishers for vessels are powder extinguishers which are good multipurpose A, B, C units for class A (paper wood textile fires), class B (flammable liquid fires), class C (flammable gas fires). In a larger vessel which has several units installed it is recommended that at least one extinguisher in the accommodation is of the foam type as powder is less effective on fabric fires as it does not penetrate the material. Foam extinguishers must not be installed in the galley as they are A,B and ineffective on gas fires.

    Powder extinguishers use very fine dry powders. Most marine diesel engines have only a coarse air filter which cannot filter out all the extinguisher powder.

This can build up an incompressible bulk in the upper cylinder when mixed with fuel and cause a hydraulic lock. Also some dry powder fire extinguishers contain ammonium phosphate powder which turns to phosphoric acid when exposed to moisture. This is highly corrosive and if drawn into a running engine can cause extensive damage. It is recommended that before tackling an engine room fire with a powder extinguisher, the engine is stopped. The only fire extinguishers suitable for use on running engines are CO2 which are class B (flammable liquids and live electrical circuits)

All fire extinguishers are stamped with an end date. This is not an expiry date and the date can be extended by servicing. Powder extinguishers will work well past their end date provided the pressure is maintained within, and the powder has not clogged in the bottom. It is good practice to shake the extinguishers periodically to feel the powder moving inside. Extinguishers without pressure gauges can be tested for pressure by weighing against their original supplied weight. Qualified service engineers can extend expiry dates by testing and recording on a service card attached. It may not be economic to have small units tested and cheaper to replace them.