MEDUSA
MARINE

Condition and Damage Report on Motor Yacht *Catatonic*

For:

Mr [redacted]

Member
Royal Institution
of
Naval Architects

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Damage Survey Report on Motor Yacht *Catatonic*

Client

This survey was carried out on the instructions of:

[redacted]

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General notes.

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. Copyright is retained by Medusa Marine and copies must not be made or distributed without specific permission of the copyright holder.

Location

The vessel was first inspected afloat at Ft Lauderdale, Florida on 14th April 2007. Later examined laid up ashore at Mistley Marine, Anchor Lane, Mistley on 26th August 2007

Purpose and scope of survey

This survey was commissioned by the client for the purpose of establishing the condition of the vessel as a result of extensive fire and subsequent flood damage, to give a comprehensive repair specification, and a valuation for insurance purposes. 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 is 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.

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. Mechanical condition of the engine was not covered by survey unless the vessel was afloat, only the installation could be assessed. 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.

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) 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 if the vessel is to maintain its value.

Category 2 (Cat 2) recommendations relate to defects which affect the efficient 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 should be considered mandatory, and are safety related defects which must be corrected before the vessel is put into commission.

The Vessel

Dimensions:	
LOA:	15.2metres
LWL:	13.7metres
Beam:	5.45 metres
Draft:	0.70 metres
Displacement:	21.0 tonnes
Manufacturer:	Teknicraft, Auckland, New Zealand.
Model or Type:	Former passenger ferry
Year of Build:	1995
Hull No.	Not recorded
Designer:	Teknicraft Design Ltd
Construction:	GRP hull and deck
Engines:	2 x MTU 199 series 600hp diesels driving Hamilton Jet HJ 362 direct drive water jets

This vessel is a foil assisted power catamaran constructed from GRP by Teknicraft of Auckland, New Zealand in 1995. It was originally built as a passenger ferry which operated between Auckland and Pine Harbour for 5 years before being superseded by a larger vessel. She was sold into private hands and shipped to California USA where she was converted into a private yacht. In 2005 the vessel was sold to a new owner in Miami Florida who moved her to Ft Lauderdale for a refit. It was during this refit that a major fire occurred on board. The vessel was declared a total constructive loss by insurers. She was purchased by the above client who intends to restore her to her original specification.

Following the initial survey in Ft Lauderdale, Florida, Medusa Marine arranged shipping to Southampton via Sevenstar Yacht Transport. The vessel was laid up at Hamble and made ready for open sea. Medusa Marine then arranged towage to Mistley Marine on the Stour river in Essex where she was lifted, shored up and given a full out of water survey.

The vessel is a foil assisted power catamaran built of GRP. She has two asymmetric planing hulls and foils. Foil assisted means that the foils do not lift the hull clear of the water but lift sufficiently to reduce drag and reduce pitching from any swell. The main benefits are in fuel consumption rather than performance. Provided the water flow remains attached to the foil surfaces and avoids a stall condition, the lift generated by the foil will increase in a linear relationship to angle of incidence whereas the drag will increase exponentially. A moderate lift foil will give good initial fuel consumption benefits with only a modest return on performance, but as the angle of incidence or the camber increases the benefits will slowly reverse.

The hulls are braced by two substantial cross beams of welded aluminium lattice design. The forward beam is incorporated into the forward bulkhead dividing the forepeak and the helm. The aft beam forms the transom of the cockpit. The accommodation is divided into 5 zones. There is a cabin with a heads compartment in each hull. The bridge deck is divided athwart ships into three zones, a forepeak cabin with a heads and shower compartment, a raised helm and galley area and deck saloon aft opening onto the cockpit. Accesses to the engines are through hatches in the deck saloon sole.

The cockpit is full width with a ladder to the flybridge. There is also access each side down winding steps to a bathing/boarding platform on each hull. Access to the jet drives are though hatches in the cockpit sole. Mounted above the jet drive in the port hull is a large keep tank for fishing with an aeration pump. Above the jet drive in the starboard hull is a Westerbeke 110/24dc volt open chassis generator.

The flybridge has a second helm station and seating. There are also the remains of a radar arch.

Summary of fire damage

The hull is constructed from solid glass fibre reinforced polyester or vinylester resins. There is little difference between these two types of resin regarding strength or fire resistance. The two resins are mainly differentiated by their permeability to water. The degradation of GRP due to exposure to excessive heat occurs in three stages. At the lowest temperatures, typically as low as 100℃, the resin will be begin to be affected by exposure to heat.

M Dao and R Asaro in their study of failure of single-skin GRP composites under fire degradation for the US Coastguard (1999) established by experimental results that structural properties of E-glass/vinyl-ester composites were progressively lost as temperatures increased. They observed 50% reduction of tensile and flexural strength at 130℃, and 100% at 200℃. Up to these temperatures however, these are only temporary losses of mechanical properties, and the GRP layup will not be structurally affected on cooling. Although GRP components subjected to stress loading can suffer permanent plastic deformation. In fact it is a regular practise in the moulding industry to adjust GRP mouldings by stressing them into the required shape and applying saturating heat.

At higher temperatures 200℃ upward the resins will start to return to liquid form. This is termed the thermal distortion temperature and the GRP moulding will buckle under its own weight. Volatile compounds, glycols and styrene, trapped within the resin will boil and outgas forming tiny bubbles. When the resin cools it will re-harden but the bubbles will remain and the resin on shrinking will form cracks.The resins on cooling can recover some mechanical properties, but the laminates will never reinstate more than 50% of their original strength dependant on the duration of exposure.

In the third stage at a temperature of 750℃ the resins will auto ignite and start to burn. The glass fibres will not burn, but the GRP will be effectively destroyed.
In practise GRP is a very poor conductor of heat and in an intense fire of short duration the degradation effect will be stratified across the lay up. There may well be no degradation of the mechanical properties of the outer laminates whilst there can be complete decomposition of the inner laminates.

It is important to note that it is impossible to say that if the GRP looks undamaged then it is undamaged. Further investigation is necessary before the laminates can be considered safe to re-instate. It can be established by the use of a Barcol Impressor if the second stage of degradation has been reached. Hardness readings of 30 to 40 Hba will indicate that the laminate is structurally sound and safe to be retained. The third stage of degradation will be most evident by the loose structure of fibres as a result of the burn out of the combining resins.

The Miami Herald reported that the fire burned for just 20 minutes and the ignition point was amongst some paints and materials for the refit being stored in the accommodation in the starboard hull. The fire quickly spread to the saloon

immediately above and to the centre of the vessel. The interior fit out was in birch faced plywood and solid birch mouldings. It makes little difference, however what the fuel for burning was, as all organic compounds commonly found on a boat, wood, plastics, diesel, paint etc all have flame temperatures around 1950℃ to 2100℃ which are well capable of completely destroying GRP. These flame temperatures are for the blue centre of the flame though, so in a short duration fire combustion of the resins will only take place if almost directly exposed to a naked flame. Destructive fire damage was thus limited to the deck head and areas immediately above the source. The remainder of the heat damage is the result of radiant heat which decreases as an inverse square of the distance.

All GRP laminates where it is evident that the resin passed the thermal distortion temperature or where the resin has started to ignite must be cut out and discarded. The remaining laminates must be treated and tested. Most of the GRP superstructure has been heavily smoke stained. It will be necessary to remove this staining from the apparently undamaged laminates first with a strong detergent solution. Then it will be necessary to grind a small layer, approximately 1mm, into the laminates to investigate. If there is any sign of bubbles having formed in the resin or if cracks have formed or if the resin has started to darken to a brown colour then the laminates will have been weakened. This can be confirmed with Barcol Impressor readings of below 30 Hba.

Where there is no visible degradation and the laminate displays Barcol readings of 30Hba plus, the laminate can be retained. A layup of 450gsm CSM followed by a layup of 200gsm WR will restore the laminates to the original specification. This will also give a good surface for any further applications such as flo-coat, paint or adhesive. The original surface, even after cleaning with detergent, will still have contamination from the smoke which would make further applications difficult to adhere.

Areas showing signs of degradation or unacceptable Barcol readings should continue to be ground back and re-examined until satisfactory surface properties are achieved. Then, provided the external profile still retains its original shape, the internal face can be laid up with alternating 450gsm CSM and 450gsm WR until the original specification thickness is restored.

1) Hull

   Bottom The hulls are conventionally laid up in solid GRP polyester or vinylester resins. The vessel is a foil assisted power catamaran built of GRP. She has two asymmetric planing hulls and foils. The main lift foil spans the two hulls and is situated just forward of the centre of mass of the vessel. The foil has three planes, two outer trapezoidal planes with a 10° anhedral and a rectangular flat central plane. The foil section is difficult to measure but looks

to be symmetrical with a thickness ratio of 9%. (NACA 0009). The angle of incidence is 4°. The two balance foils are located one on each hull facing each other at the aft extremity. They are trapezoidal in shape with a moderate sweep. Mounted at an anhedral angle of 10° and a thickness ration of 9% and an angle of incidence of 4°

An inspection inside the hull at the mounting points of the foils show that they have been through bolted without any additional padding to the hull lay-up to distribute the load. There are signs that the mounting bolts have been weeping water. Particularly in the main lift foil access to the mounting bolts has been complicated by the double construction of the cabin soles. Access hatches in the soles do not occur in the same place. It is likely that previous owners or surveyors have not been able to observe the problem.

The hull bottom is painted with a grey antifouling paint. This is intact with no signs of peeling or flaking.

Topsides The topsides have been painted in a dark blue paint over the original white gel coat. There are many localised areas of star crazing in the gel which shows through the paint. These need to be investigated.

Most star crazing is purely cosmetic, moisture is unlikely to penetrate to the laminate in the topsides and can easily be detected with a moisture meter. It is nevertheless important to establish the origins of any crazing in the gel coat to try to prevent it happening. The appearance of the crazing is an important indicator. Star crazing which appears as concentric circles or half moon shapes are usually the result of an impact on the outside of the hull. These can only be avoided by skill and care of the helmsman and crew.

Star crazing which appears as a star of radiating cracks from a central point are usually the result of an impact on the inside of the hull. This is often a result of poorly secured heavy items of equipment, anchors, outboard engines etc impacting on the inside of hull when the boat is slamming in a seaway. These can be avoided by stowing heavy items carefully, or fitting a cockpit locker or anchor locker with a sacrificial lining of plywood.

Crazing which is a series of near parallel lines is where the internal structure of bulkheads has locally prevented a lightly built laminate hull from flexing to absorb impact. This is usually accommodated at the design stage with a ‘crush bonding’ where a narrow strip of foam is installed where the bulkhead butts onto the hull and is bonded in. This is a concerning form of stress crazing because no amount of cosmetic repairs will prevent it from re-occurring. It is that latter type of crazing which is most evident in the hull, mainly around the outer forward sections in the topsides.

There are also numerous abrasions in the paint finish in the topsides. It is understood that the owner is expecting to have to do a complete topsides re-spray anyway. There is an aluminium and PVC rubbing band at mid height of the topsides. This is in good condition.

Recommendations
(Cat 2) it is expected that all the partial bulkheads which form the fit out for the accommodation in the hulls will be removed. All the bondings will also be removed. Partial bulkheads where stress crazing has occurred should be reinstated with crush bondings. These can be achieved using Corecell which is cut to the width of the bulkhead and double the width at the hull face so that it forms a fillet for the bondings.
(Cat 3) Fastenings for the foils should be removed and substantial plywood pads with deeply chamfered edges should be installed and laminated over. The mounting bolts must be re-fitted with large 3mm stainless steel backing plates.

2) Deck

The hull has effectively raised topsides as there is no side deck. The main deck is heavily cambered from the raised topsides with no toe rail. It appears that it was never intended in the vessels original design for the deck to be a working area for the crew. This is evidenced by the lack of a toe rail or non slip surfaces on the steeply sloping foredeck. There is no distortion visible in the surface of the foredeck but this is unlikely as the fire did not spread to the forepeak below.

Recommendations
(Cat 3) Non-slip paint must be applied to the foredeck. It is also recommended that a moulded toe rail or an aluminium extrusion with a substantial 5cm upstand should be added to the deck in the line of the stanchion bases of the pulpit. This must also run across the bows between the hulls.

3) Superstructure

Coachroof The superstructure is integral with the deck moulding and features eight toughened and tinted glass windows. The coachroof top is supported by substantial box section pillars set behind the glass.

There is significant thermal distortion in the top of the coachroof above the lower helm station. The aft face of the coachroof forms the front of the flybridge helm. This also demonstrates thermal distortion.

Recommendations

(*Cat 3) Damaged section in the coachroof must be cut out and re-made.*

Flybridge The flybridge has been effectively destroyed. The flybridge sole is moulded with a foam core. The under skin which forms the saloon deck head has been burnt through and only the upper skin remains which is severely weakened. The mouldings for the helm and seating have suffered serious thermal distortion and partial burning of the resins.

Recommendations
(*Cat 3) The entire flybridge sole and aft rail must be cut out and re-made new.*

4) Windows and portlights

The coach roof windows are eight toughened glass panes. Theses are bedded down on sealant in a flange formed by the rebates in the supporting pillars and the top and bottom mouldings. Three of the glass panes have shattered and the remainder have been heavily smoke stained.

In the raised topsides of the superstructure are the provisions for long teardrop shaped side windows. These are blanked out with black acrylic and the joinery has been built across them in places. There are signs of old fastenings having been removed. It appears that in this vessels first use as a high speed passenger ferry, these were side passenger side windows.

Recommendations
(*Cat 3)If it is desired to keep these apertures blanked out, the infill should be laminated in GRP. A mould face can be screwed to the outside and waxed. This should be double gel coated and a lay up applied in the same spec as the superstructure sides.*

5) Deck gear and fitting

There are minimal deck fittings. There are forward and midship cleats but they are too light duty for the displacement and the windage of the vessel. There are also no fairleads.

A vertical windlass is installed in the deck forward. This is undamaged.

Recommendations
(*Cat 3) Substantial cleats and fairleads must be installed with substantial backing plates.*

6) Safety equipment

An all surrounding pulpit was fitted, but only the forward section and the rail around the back of the flybridge now remain. This is a bit wobbly but this could be because it is only a part section. When long side rails are used with raked uprights for styling purposes, the resultant rail is going to be less stable than vertical uprights. This pulpit has just welded plates fitted to the bottom which are not particularly supportive.

There are no other safety features installed.

Recommendations
(*Cat 3) When the pulpit is remade it is recommended that more substantial deck fastenings are used. Cooney Marine manufacture a range of substantial cast and polished stainless raked stanchion bases with 10mm bolts and thick backing plates.*

7) Skin fittings and seacocks

There are a large number of skin fittings in the hulls. Each of the five air conditioning unit has three skin fittings, two for the cooling pump and one for the drain. It is not known whether new air conditioning units will be installed. All these hull openings have yellow metal mushroom type skin fittings and glass filled polypropylene ball valves. The skin fittings sound dull when rung and the hoses were double clipped with stainless steel worm drive hose clips

There are three heads compartments, one in the port hull forward for the fore peak cabin, and one each side for the side cabins. Each of these heads has an inlet and an outlet skin fitting. All these hull openings have yellow metal mushroom type skin fittings and glass filled polypropylene ball valves. The skin fittings sound dull when rung and the hoses were double clipped with stainless steel worm drive hose clips.

Each engine compartment has a skin fitting for the cooling water intake. These are mushroom type yellow metal with yellow metal ball valves. These sounded well when rung and were of good colour and the hoses were double clipped with stainless steel worm drive hose clips.

In the port side the keep tank has two skin fittings for the drain and the pump. These skin fittings were in plastic with no valves installed but the hoses were double clipped with stainless steel worm drive hose clips.

In the starboard side the generator had one skin fitting for the cooling water intake. This was a yellow metal mushroom type skin fitting with a yellow metal

ball valve. It rung soundly and was of good colour and the hoses were double clipped with stainless steel worm drive hose clips.

Recommendations
(*Cat 3)The term yellow metal is used because it is not possible to ascertain what alloy has been used, as these were of far eastern manufacture. Due to the extensive nature of the hull repairs necessary it is prudent that all skin fittings and ball valves are replaced with new bronze or DZR (de-zincification resistant) Alloy. There should also be wooden bungs of a suitable size securely located beside each skin fitting. These can be secured by a short lanyard to the skin fitting. An alternative which is less inconvenient when located in a storage compartment is to stick the bung to the hull side with a generous blob of silicone. It is likely that the air conditioning units and the keep tank will not be replaced/re-installed. In that event the skin fittings must be removed and the holes laminated over. Because these are below the waterline the holes must be repaired from both sides. That means a 12:1 feather edge is ground from both inside and outside equally and laid up from both sides to over spec of the original lay-up. This will insure that there is a mechanical as well as an adhesive bond to the hull.*

8) Engines

The engines are a pair of MTU Series 199 Diesels, developing 600 hp each at 2800 rpm. The base engines are 14 litre Mercedes 6 cylinders turbocharged industrial diesels marinised by MTU. The engines are mounted on girders slung between floors moulded to the hull bottom. The engines appear to be unaffected by the fire although some of the electrical wiring ducting actually fastened to the roof of the engine bays have melted. The engines are indirectly cooled via a heat exchanger which draws raw water via a skin fitting and through a water strainer mounted above the water line. The engines are in good external condition. The engines are fitted with a reversing electric oil pump for filling and draining the sump. It was possible to jump this from a battery and draw off some sump oil. The oil was free from particulatesand emulsification.

The throttle control system is a manual hydraulic setup with a ram operating the levers on the injector pump and controlled from a hydraulic throttle lever on the helms. The system could not be tested as the neoprene pipes were melted, but it is a well engineered system with considerable benefits over Bowden cables over long runs and with dual helms. They engines could not be run as they are direct drive to the Jet drives which are not free to turn without damage to the impellers.

9) Fuel system

The fuel tanks are all welded stainless steel construction and mounted in bays immediately forward of the engines. They were accessed by cutting sections out of the saloon floor. There was no routine access. It is suspected that these tanks are not original as there are indications that the interior layout was changed when the vessel was converted to a private yacht. The conversion was not carried out by an experienced boat builder as many practises are not to an acceptable standard. There are no inspection hatches to the tanks and they have been made to fit the profile of the bay and set in and injected all round with expanding polyurethane foam.

Investigations in the engine bay show that the foam injected round the tank on the starboard side is saturated with diesel. Furthermore the fuel feed hose to the engines are automotive water hose, not fuel hose. It also appears that the feed from the tanks exits at the front of the tank and the hose runs underneath and passes through the aft bulkhead. It is suspected that the hose has perished and fuel has saturated the foam.

The fuel is passed through a pair of dual switchable filter separators. The fuel then passes through a Flo-Scan electronic fuel monitoring system. This is a dual sensor unit which nets off the fuel feed through the supply and the return to calculate the actual fuel consumed. Each of the four sensor has a pulsation damper fitted and one of these on the starboard engine has been punctured. All the fuel lines after the filter units is in copper pipe. From the Flo-Scan units the fuel feed to the engine and the return are in braided rubber hose.

Recommendations
(*Cat 3) Both fuel tanks must be replaced with new tanks. These must have inspection hatches of minimum 30cm diameter. Tanks should have internal baffles to prevent surge and be pressure tested to 1.3 bar and have siphon tubes for the fuel supply. All fuel hose must be to ISO 7840. Tanks must be mounted on welded flanges with adequate ventilation all round and covered by lifting hatches for regular inspection.*
(Cat 3) the Flo-Scan pulsation damper that is punctured must be replaced. The processor unit and the display on the lower helm has been destroyed so a more practical option is to remove the whole system from the fuel supply line.

Steering is by double acting equal displacement hydraulic cylinders operating steering nozzles on the jet drives via tiller arms. The hydraulic steering pumps are situated at two helm stations, one on the fly bridge and one at the lower helm. Both pump units have been effected by heat and all the neoprene hydraulic hoses have been burnt through. The hydraulic cylinders are still in a serviceable condition.

10) Stern gear

Propulsion is by a pair of Hamilton Jet HJ 362 water jets. These are direct drive from the engines via a Cardan shaft which is a balanced double Universal Jointed shaft. The shaft is enclosed in a stainless steel hoop which protects the hull from serious damage should one of the UJ's fail. This hoop is far too large with about 6 cms clearance and should be as close to the shaft as possible as the minimum the shaft moves out of line the less the force required to restrain it. If one of the UJ's failed at 2800 rpm the present hoop would almost certainly fail to prevent serious damage.

The engine and propeller shaft have been set directly in line with the jet drive input flange. Ideally the input flange of the drive and the output flange of the engine must be parallel but NOT in line. The UJ's must be made to work through a small angle. This makes the needle roller bearings rotate inside the yokes and distribute the load and the wear uniformly. Perfect alignment of the drive train will lead to premature failure of the joints.

Direct drive means the jet drives run at engine revolutions with minimal power losses through transmission. The jet drive units are in reasonable condition externally. The steering nozzles and thrust reversing buckets all move smoothly. The port drive is semi-seized and the starboard drive is completely seized. This is not unusual for jet drives which have been left afloat and unused for an extended period.

The casings are cast in LM6 Aluminium and the impellers are in cast 316 stainless steel. The impellers turn in a stainless steel liner with a minimal tip clearance to minimise loss of thrust. The stainless liner fits tightly inside the alloy casing. Electrolytic corrosion of the alloy can distort the thin stainless steel liner enough to seize the impeller. The liner is intended to be a sacrificial item so replacement is not a difficult job.

Forward and reverse control is a hydraulic ram operating the thrust reversing bucket. This is powered by a pair of Haldex Hydraulics 24 volt hydraulic power packs, one for each drive and located under the bench seating in the saloon. These units are solenoid controlled by a joystick on each helm. The units were jumped from a battery and both found to be serviceable.

Recommendations
(*Cat 3) Strip and service the jet drives. Remove the old impeller liner and clean off any oxidised aluminium. Install a new liner on Zinc Chromate paste. (Cat 2) Make and install a smaller propeller shaft restraining hoop with a maximum 2 cms all round clearance from the shaft.*

11) Steering system

Steering is by double acting equal displacement hydraulic cylinders operating steering nozzles on the jet drives via tiller arms. The hydraulic steering pumps are situated at two helm stations, one on the fly bridge and one at the lower helm. It is a non-powered system although there is a powered pump in the line for an autohelm. Both pump units have been effected by heat and all the neoprene hydraulic hoses have been burnt through. The hydraulic cylinders are still in a serviceable condition.

12) Sea toilets

All the sea toilets will need to be replaced. Their location will be defined by the new accommodation lay out.

13) Fresh water system

The fresh water tank is located in the port hull between the fuel tank bulkhead and the cabin. It is in a satisfactory condition and has been properly mounted on bearers and with welded flanges. Distribution is by a centrifugal pump and accumulator tank. The pump was jumped from a battery and found to be serviceable although the accumulator tank either needed re-pressurising or the diaphragm had failed. All the pipe work to the galley and where it ran to the other cabins has been fire damaged and will need to be replaced.

Recommendations
(*Cat 2) Re-pressurise to 1.5 bar or replace accumulator.*

14) Electrical system

The vessel is equipped with 110 volt ac, 24 volt dc and 12 volt dc systems all are supplied from a Westerbeke 11 kva diesel generator in the starboard engine space. Immediately above in the forward face of the main bulkhead is the electrical distribution board. Most of this has survived destruction but all the wiring insulation has been compromised by heat and should all be replaced. Past experience with both extensively water damaged and fire damaged vessels has shown that it is quicker and cheaper to scrap the whole system and start from scratch than to try to identify, test and recover part systems and mix it with new.

All of the five accommodation zones in the vessel was individually supplied with an Aqua-Air MC05 reverse cycle air conditioning unit. Two of these units,

in the fore peak cabin and the port cabin as in a serviceable condition. It is the owners choice as to whether air conditioning is desirable in the refit.

15) Gas system

There is no gas system on this vessel

16) Fire fighting equipment

There is no fire fighting equipment left on this vessel.

Recommendations
(*Cat 3)When refitted it is recommended that the vessel is equipped with sufficient fire fighting equipment to meet the MCA Code of Practise requirement for commercial vessels up to 24 metres.*

17) Bilge pumping

The vessel is equipped with 6 bilge bumps. All are of the 12volt electrical centrifugal type fitted. One is mounted in each engine bay, one in each side cabin and one each side in the fore peak cabin. All discharge through skin fittings high in the topsides. There are also two manual bilge pumps, one in each engine bay. All are serviceable although the electrical supply to the electric pumps has been damaged.

Recommendations
(*Cat 3) Install manifold arrangement of diverter valves to allow manual pumps to draw from the forward compartments.*

18) Interior fit-out

The interior fit out is all executed in birch faced plywoods and solid birch joinery. It is totally destroyed in the helm, saloon and starboard cabin. The forepeak cabin and the port cabin joinery is intact but smoke damaged. It is the owners intention to replace all the joinery with new fit out.

When the interior was re-fitted as a private yacht the helm and saloon soles were cut into to provide alternate access to the hulls. The soles are constructed of foam cored GRP. Where the cuts were made the edges were not sealed, also where joinery was installed and pipes and wiring run the surface laminates were cut into. As a result of the cabin windows being broken and not properly shuttered, the foam core of both saloon and helm soles are saturated.

All galley units were removed in the US prior to shipping to reduce weight and damage from heavy unsecured items.

Recommendations
(*Cat 3) The surface laminates of the helm and saloon soles must be cut out and the saturated foam removed. The surface must be thoroughly cleaned and keyed up. One layup of 450gsm CSM must be laid followed by a layup of 450gsm WR. Then lay sheets of Corecell M plain onto a wet resin bed. Allow to cure and then lay-up 3 x 450gsmCSM alternating with 3 x 450gsm WR. All apertures in the sole are to have the foam cut back by10/12 mm and the gap filled with resin thickened to a paste with colloidal silica then laminated over with two layups of 450gsm CSM wrapping round the sole by 7cms.*

19) Additional equipment

All items of equipment that was not permanently installed were removed prior to shipping.

Summary of recommendations

Detailed recommendations can be found in the body of the report

Hull recommendations
(Cat 2) Replace bulkheads with crush bondings
(Cat 3) Reinforce the foil fastenings.

Deck recommendations
(Cat 3) A non-slip paint must be applied to the foredeck. Add a toe rail

Superstructure recommendations
(Cat 3) Damaged section in the coachroof must be cut out and re-made.
(Cat 3) Flybridge sole and aft rail must be cut out and re-made new.

Windows and portlights recommendations
(Cat 3)Side window infill should be laminated in GRP.

Deck fittings recommendations
(Cat 3) Install substantial cleats and fairleads
(Cat 3) Install substantial deck fastenings for pulpit.

Skin fittings recommendations
(Cat 3) Replace all skin fittings and ball valves

Fuel system recommendations
(Cat 3) Replace fuel tanks with new tanks
(Cat 3) Repair or replace the Flo-Scan system

Stern gear recommendations
(Cat 3) Strip and service the jet drives.
(Cat 2) Install a smaller propeller shaft restraining hoop.

Water system recommendations
(Cat 2) Re-pressurise to 1.5 bar or replace accumulator

Fire fighting recommendations
(Cat 3) Install new fire fighting equipment

Bilge pump recommendations
(Cat 3) Install manifold arrangement of diverter valves to bilge pumps

Interior fit out recommendations
(Cat 3) Replace laminates of the helm and saloon soles

Conclusions

The repair and restoration of this vessel is a major project. No costings can be prepared until the strip out and full examination of the fire damage to the GRP hull and superstructure is completed.

The fire started in the starboard hull cabin and spread to the saloon and helm area. Reports in the Miami Herald stated that the fire burned for 20 minutes before being extinguished. This is a relatively short time for a vessel fire. The combination of the many flammable materials in a vessels construction, tight confined spaces and limited hull openings can mean a blast furnace effect is created which conventional fire fighting methods make almost impossible to control. The usual result is a vessel is cut adrift and allowed to burn to the waterline. This boat was lucky that a marina crew was able to tackle it before it got out of control.

Actual fire damage has been limited to the starboard cabin, saloon and helm. The forepeak cabin and port cabin are undamaged by fire. As the heat rose everything below the main deck level where most of the expensive engineering hardware was, is relatively unscathed. All the zones have been heavily smoke damaged but all the hard surfaces could be recovered.

Significant extra costs will be incurred to make the vessel suitable for use as a leisure craft in the UK. Its origins as a passenger ferry are very obvious. It is evident that the use of water Jet drives was key to the process of mooring the vessel whilst passengers were boarding. The thrust reverse buckets would be deployed and the engines left to idle which would pin the vessel stern to a dock. For this reason the only access to the vessel from dockside is from directly astern. The boarding platforms do not even wrap round the stern quarters sufficiently to allow any access from an alongside pontoon. There are no side decks and the fore deck slopes too steeply to be safely useable by crew. There is also a complete lack of toe rails or guard wires and the only cleats substantial enough to moor a vessel weighing 21 tonnes are fitted to the aft quarters.

Plans obtained from the Teknicraft Design Ltd show that the original planned displacement as a passenger ferry was 11 tonnes. Allowing for passengers and luggage of an additional 3 tonnes (40 x 75 kilos), makes for an operational gross displacement of 14 tonnes. When the vessel was lifted at Mistley the load cell measured her weight at 21 tonnes as quoted in the specification at the head of this document. Some weight of water can be accounted for in the saturated cores in the saloon deck mouldings, water in the bilges and saturation of the injected foam lining the fuel tank bays.

In the main the extra weight can be attributed to the fit out when the vessel was converted to a private yacht in California. It is rumoured that the fit out was done by a shop fitting company and the technical understanding shown in some of the work would support this theory. It is evident that much of the fit out joinery is installed over

the original. All the lower cabin soles are installed on top of the original soles separated by about 5 cms creating a double bilge. It will be necessary to completely strip the whole accommodation fit out back to a bare hull before re-fitting if the vessel is to reach her original design speed of 40kts. The new owner is very keen for the vessel to achieve this.

To avoid stating the obvious, it was needless to say that items destroyed in the fire would need to be replaced. This survey only addresses the structural, safe and efficient operational components of the vessel. The refitting of the accommodation and the installation of new electrical and electronic navigation systems, and domestic water and waste systems is a matter of choice for the owner and does not need to be defined at this stage.

When the restoration is complete it may well have proved less costly to have obtained a set of new mouldings from a UK contract moulder and fitted it out to the same specification.

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