February 7, 2021

Progressive Insurance
Attn: Mr. Matthew Lynch
3570 E Foothill Blvd
Pasadena, CA 90032

COMPANY #: 20-1068426
INSURED: Fernald, Brandon
DATE OF LOSS: 10-23-20
HCSS FILE #: 213156-20

FIRST REPORT

PO Box 14761 Springfield, Missouri 65814 P: 417-929-0005 F: 417-929-0002
Email: michael@huntersurveying.com Web: www.huntersurveying.com

ASSIGNMENT:

This assignment was received via phone and email January 29, 2021. This is a cause of loss and scope of damages investigation pertaining to the reported allision of the vessel's running gear of your insured's vessel which resulted in failure of the transmission and propeller shaft. This report serves to certify the undersigned marine investigator & surveyor has personally attended the vessel in order to ascertain the nature, cause, and extent of damages.

INVOLVED VESSEL:

The vessel was described as a 2001 Sea Ray 340 Sundancer bearing Hull Identification Number (HIN) US-SERT705G001. Policy information was not provided with the assignment.

FINDINGS & OBSERVATIONS:

Inspection of the involved vessel and its removed transmission & propeller shaft took place on February 4 & February 5, 2021 respectively. The vessel was observed at its mooring location, California Yacht Club, Basin F, Slip 1314 and the replaced transmission & shaft were examined at CC Marine. Both are located in Marina Del Ray of Los Angeles, California. The enclosed photographs detail my observations at the time of the inspection.

The vessel was observed afloat in its berth with no one else in attendance. The engine compartment was accessed. The transmission, which was reportedly renewed prior to my

receipt of the assignment, was identified as the port side engine's. The vessel had reportedly been returned to service. It is noteworthy both engines appear to have been replaced with 8.2 litre MerCruiser Horizon Gasoline engines with both bearing a 2019 Date of Manufacture. The exhaust systems for both engines appear to have been modified and lengthened and several other "vessel safety" items were observed during my inspection. These observations and recommendations are detailed first in this report as they are considered safety related items. I am advised this vessel has previously been examined by another Marine Surveyor and I presume given the obvious nature of these issues, the other surveyor has commented upon them. This does not constitute a full and complete survey, only readily visible observations during my inspection. Numerous electrical deficiencies were also identified.

Engines have been renewed with 2019 MerCruiser 8.2 Horizon V-Drive gasoline engines.

Modifications to engine exhaust systems do not appear to meet standards. An extension of proper design has been fiberglassed in place with single layer of glass and resin. Clamps are not properly installed

Exhaust hoses do not appear to be fully seated on muffler and improperly sized clamps installed.

Aft port side interior of engine space exhibits evidence of historical leaking fuel from above. Suspected fuel fill leak – a well known condition on this model of vessel.

Suspected fuel leaking down bilge blower ducting from above.

Port side fuel hose appears to have staining from external leaks. Additional examination if highly recommended.

Improperly installed exhaust hoses and clamps. Carbon Monoxide exposure hazards.

Batteries are installed between stringers without boxes or covers. Batteries are installed directly under starboard engine fuel system in violation of 12 inche umbrella – preventing of off-gassing during charge.

In-line fuel filter installed to supply hose of generator is not rated for installation in gas engine space.

Water hose is cut by improper installation of hose clamps creating potential & significant point of water ingress.

Generator siphon break appears to be leaking can allow water reversion to generator.

Starboard fuel fill hose appears to be staining from above.

Starboard fuel fill hose appears to be leaking (not actively present) during fueling. Staining of the hose exterior and hoses below it suggest significant leaking of fuel. Hose should be immediately inspected for condition as it an explosion hazard.

Fuel filter installed in engine space not permitted for gasoline engine compartment.

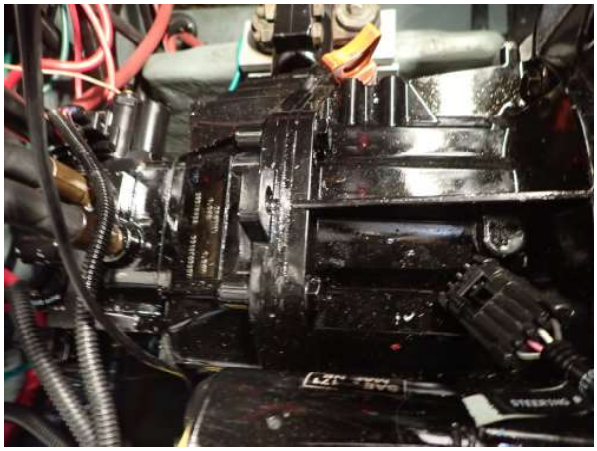
Modifications to exhaust components.

The starboard transmission appears to be OEM to the vessel by model, but is a remanufactured assembly by MerCruiser Marine Remanufacturing. Part number 663745R02 designates a ZF Hurth 630-V V-drive transmission with a 1.5 gear ratio. This gear ratio is no longer used, in consideration of the 2019 model year engines. MerCruiser information indicates use approximately 1996 to 2002, accurate to the year model of the vessel.

Transmission Part and Serial number designation plate.

Engine Serial and model information affixed to one of the engines indicates manufacture date of July 2019 serial 2A675671.

The reportedly replaced port side transmission also appears to be a remanufactured assembly of a 1.560 / 1.567 gear ratio. A manufacturer is not immediately identifiable.



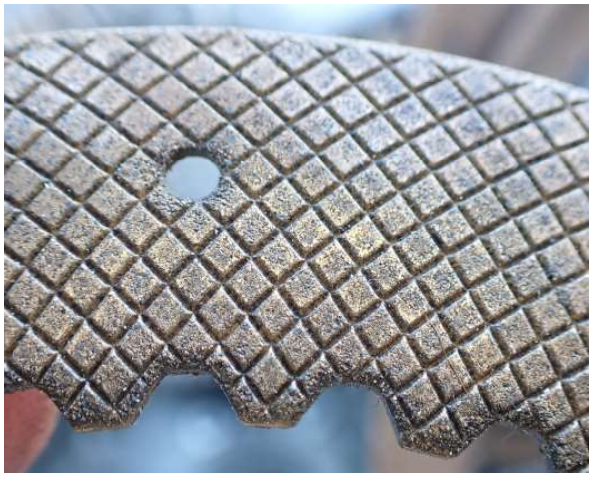
Replaced port side V-Drive Transmission.

The original transmission and propeller shaft were located at CC Marine also of Marina Del Ray. Inspection of those components was completed the following morning. The repairer's technician "Manny" accompanied and directed me to the components. The transmission was observed in a disassembled state. Transmission plates were the first presented with all the plates revealing high temperature discoloration. The plates were scored and warped due to excessive heat. The brass plates were worn severely with little surface profile remaining. Of the 11 plates, 6 were deformed and cupped consistent with excessive heat. No brass peeling or crushing was present.

Clutch plates exhibit slipping and worn plate surfaces. Plates show irregular surface contact with deformation inducing the irregular contact. Heat produced by uneven contact.

Heat discoloration of plates.

Plate surface topography exhibits overheating and cavitation around circulation port. Uneven surface wear evident.



Surface topography of clutch plates exhibit slipping and uneven wear.

Clutch plates are deformed from excessive heat.

Clutch plate steels exhibit extensive slippage and heat discoloration.

Metal residue throughout transmission components.

Transmission tapered bearings and rollers all appear in good condition. No bluing, heat, scoring, or misalignment evident.

Gear teeth of transmission all in good condition with no evidence of overload. Normal alignment evident. Plate metal is circulated on all components.

The propeller shaft was reported to have sustained a catastrophic overload from allision as evident by a fracture supposedly originating at the propeller keyway. The propeller was not presented for inspection. However, upon being presented the propeller shaft, it was immediately noted the shaft fracture originated at the transmission coupling end of the keyway, not the propeller end. I made inspection of the propeller end of the shaft first noting no evidence of keyway impingement. The key was not present.

Propeller end taper and keyway of propeller shaft. Evidence of poor propeller fit but no evidence of overload present.

Propeller end keyway at taper exhibits no fractures. The loose propeller has produced minor rounding of the keyway shoulder. No overload damage present.

Keyway floor shows of slipping key. Rounding of the shoulder demonstrates the key was rolling over the shoulder resulting in its long-term deformation.

Propeller shaft coupler and propeller shaft end as presented. Metal fatigue is demonstrated in topography of the fracture surface.

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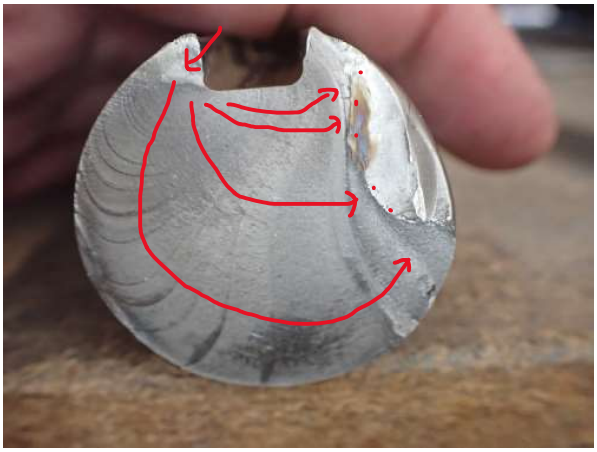
Propeller shaft end and coupler at keyway reveals deformation of the shaft end keyway in both directions.

Keyway cut and internal taper of coupling shows loose fit and apparent coupling and shaft misalignment.

Fracture topography in propeller shaft reveals origin / incipience of the fracture propagation at the left side of the keyway. Over time, the fracture has propagated to the area of final failure at the right side of the fracture where the last 10% approx. of the shaft remained.



Fatigue propagation overly apparent in fracture topography.

CONCLUSION:

The safety related items addressed in the report are generally external to the inspection for the reportedly loss aside from setting the precedent for a significant amount of prior repairs to the vessel have been completed at least since 2019. Those repairs appear to have been completed in an improper manner.

Initial information you provided detailed a failure to the propeller shaft and transmission were reportedly the result of an allision or some form of overload failure. However, the inspection of the propeller shaft found the fracture to have originated at the forward end at the transmission coupling, not the propeller end. In consideration of a propeller shaft, the material is ductile and has an inherent elastic and plastic limit over its length. Hence, the input force from an allision or overload would be greater at the propeller end of the keyway as opposed to the coupling end. Fatigue failure in metals may or may not have an initial stress due to the presence of stress risers, notches, or inclusions no longer being evident. Fatigue is generated by the alternating plastic strain in amplitude to propagate the small micro-cracks in the surface.

The fatigue failure process is generally divided into five categories as cited by American Society of Materials Vol. 19. Stages are as follows:

1. *Cyclic plastic deformation prior to fatigue crack initiation.*
2. *Initiation of one or more micro-cracks.*
3. *Propagation or coalescence of micro-cracks to form one or more micro-cracks.*
4. *Propagation of one or more micro-cracks.*
5. *Final failure.*

The photograph of the presented shaft fracture topography clearly demonstrates all phases of the fatigue process.

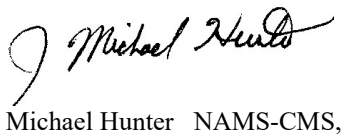
The transmission inspection failed to reveal any evidence of overload to any of the gears, bearings or splines. Instead, heat development in the plates was present along with heat-based warping of the both the steel and brass plates. Not a single aspect of this type of damage is consistent with a single event of overload.

The components presented for my review in no way are they consistent with an allision with a submerged object. Findings and conclusions are the result of a review of all presented materials and applied to a proper scientific method. Upon review of the components, hypothesis were developed and evaluated for accuracy. Observations as pertaining to gears and bearings were assessed based upon AGMA and ABMA applicable standards of Failure Analysis. I am unable to advise allision or overload as a cause of loss to either the transmission nor the propeller shaft.

TO BE DONE:

The forwarding of this report concludes our handling as assigned. I reserve the right to modify or expound upon my findings and opinions in the presentation of additional information or evidence.

Hunter Consulting & Survey Services, Inc.



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National Association of Marine Surveyors – NAMS-CMS 125-949
Society of Accredited Marine Surveyor – SAMS AMS#939
Certified Marine Investigator – IAMI CMI#1828-016
American Society of Non-Destructive Testing – Level II Thermographer NDT
American Boat & Yacht Council – Master Marine Technician
American Boat & Yacht Council – Certified Marine Systems/Composite Boat Builder/Standards/Electrical/Corrosion/ Diesel/ Gas