



## CAPTAIN'S LOG: WORST CASE SCENARIO

By Teresa Drugatz, Advanced Mechanical Enterprises/AME

# Vicious Vibration

■■■■ **THE SEA WAS CALM** as the guests of *M/Y Quiver* enjoyed an evening of fine dining and cocktails on the aft deck as they cruised eight miles off the coast of the Exumas. They were grateful for the clear skies — if it had been raining, they would have been eating in the dining room where the vibration and noise had been so loud for the last 10 days, it had been necessary to wear ear protection. Capt. Peter and his crew had intended to have the vibration assessed, but had jumped at the last-minute charter, thinking they could hold off for another two weeks.

Just as dessert was served, alarms sounded. Capt. Peter and Chief Engineer Stefan scrambled down to the engine room to see what was happening. The vessel was quickly taking on water, making it difficult to locate the breach. After inspecting the pumps, exhausts and the surrounding areas, it became obvious that their two weeks were up — the Cardan driveshaft bolts had sheared at the engine, destroying the aluminum guard and cracking the hull. Quickly alerting the crew to deploy the tenders, the charter guests were immediately taken safely to shore (without personal effects and valuables) as the captain used what power he had to get the vessel to shallow water before the inevitable occurred.



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“The signs here were very loud and clear,” says Rich Merhige, president of Advanced Mechanical Enterprises in Fort Lauderdale. “Noise and vibration [aren’t] just annoying, [they’re] a red flag saying there’s something wrong or something is about to go wrong very soon. The high-pitched whining sound that had the guests wearing ear protection was actually high gear tooth vibration caused by misaligned gearbox components. When the damage is this far along, you make yourself vulnerable to serious mechanical and potential safety issues.” As soon as the vibration and noise was heard and felt, the captain should have contacted a company specializing in vibration analysis. A brief sea trial, when vibration data could be collected, would have pinpointed exactly where the vibration was coming from and what mechanical components needed attention for corrective maintenance.

The damage was far worse once the hull was compromised. A temporary repair to the hull was necessary to get the vessel floated and into the yard. The vibration, caused by severe driveshaft misalignment and incorrect mount loading, worsened over time, ending in the shearing of the bolts and ultimately cracking the hull. The misalignment was exacerbated because the custom feet on the gearbox mount did not provide sufficient support. In the presence of mechanical “looseness,” the misalignment occurred under load due to the forces from the propeller.

Besides the obvious repairs, which included comprehensive glasswork and cosmetic restoration, the flooded hull meant that all of the

lower-deck equipment, machinery and furnishings either had to be repaired or replaced. Additionally, the necessary mechanical attention required was quite extensive — the gearboxes and main engine crankshaft had to be completely disassembled and inspected and the Cardan shaft renewed. Once all was in order, the running gear was precision aligned to restore machinery vitality. The main engine and transmission mounts were re-engineered to provide more stability to correct the root cause of the failure and, finally, a post-works vibration survey was performed to ensure repairs were thorough and sound.

“In a perfect world, a baseline survey would be conducted for every new commission and every time a yacht exchanges hands,” says Merhige. “Once this is done, biannual vibration surveys can predict potential problems before anything is heard or felt. If you’re hearing something, chances are you’ve waited too long, and you’re looking at major repairs for a variety of things such as the props, shaft, struts, bearings or pumps.... Vibration analysis is a proactive approach to maintaining your vessel’s mechanical health.”

Had the vibration been evaluated earlier, *M/Y Quiver*’s problem could have been easily fixed by modifying the mount feet to provide adequate support. Once the gearbox was aligned to the stern tube and confirmed using laser alignment, the mounts would’ve been set in place with Chockfast Orange epoxy.

“I routinely get vibration surveys done to ensure there are no surprises,” says Capt. James Smith of *M/Y Dragonfly*. “This way, our maintenance is proactive. We’re addressing mechanical deficiencies before they escalate and cause a serious problem. The investment is well worth the peace of mind.”

New on the horizon of vessel maintenance is online condition monitoring. These systems allow experts to monitor machinery remotely, 24 hours a day, seven days a week, if necessary. This makes the crew’s job — and that of the engineers and technicians — that much easier.

“This type of preventative maintenance is going to be even easier to manage in the very near future,” Merhige predicts. “We use highly sophisticated online condition monitoring systems for many of our commercial clients — it’s only a matter of time before yachts jump on board.”

Hindsight is always 20/20, but if *M/Y Quiver* had heeded the warning signs, the repairs and ensuing downtime would have been prevented.

The lesson learned? Listen to what your machinery is telling you. **DW**

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