
PHOTO: DAVE GERR

Getting It Straight

So you've bent the props...and a few other things. Now what?

By Capt. Bill Pike

Let's say you're at the wheel of your 55-foot twin-engine motoryacht, *Seafarer*. Night's fallen, you're down bound in some skinny backwoods tributary, and as you ease around a piney point, you spot another boat dead ahead, crosswise in the channel with her lights ablaze, obviously hard aground.

You jam your throttles into reverse, backing down vengefully to avoid a collision. But being disoriented, you overdo the maneuver and slam the stern into some rocky shallows below the point. Bumpity. Bumpity. Bump! The tachs flatline and the wheelhouse goes church-mouse quiet except for a faint scratching from the VHF and the far-off existential hum of the genset.

Welcome to the club. Most everybody's run aground one time or another. And most everybody who's done it up big-time will tell you that after the initial trauma, there follows a second that's almost as bad—the bitter moment when the yard bill descends upon you like a guillotine blade. Whop!

The reason for this awfulness stems from a common misconception. Most people think grounding repairs should be simple and cheap—after all, how much time and effort could be necessary to straighten and reinstall a few bronze and/or stainless steel parts? But the truth of the matter exposes such an attitude for what is really is: naive. A typical inboard alignment and reinstallation is expensive—as much as $10,000 or more for a large inboard boat. Why? Because not only do running-gear parts have to be reshaped or straightened, they have to be realigned with *extreme* care. If they're not, shaft wobble, bearing wear, and resonant vibration will turn your boat into the maritime equivalent of an oscillating sander.

There are four basic "sighting" methods for realigning a power train. We're going to describe each so that you can make informed choices after a grounding and before you get an ultra-hefty yard bill. But first you need to understand a few preliminary details.

Let's return to *Seafarer*, which now sits in a modestly accoutered but competently staffed boatyard. We know the yard is a decent one, by the way, because its employees have done careful detective work on her while she was still in the water, checking engine mounts for movement, shaft couplings for mar marks, stuffing boxes for radical shaft misalignment, and fiberglass surfaces for stress cracks. Then they hauled and positioned her with equal care using jack stands and wooden blocks, knowing that any "sag" or "hog" would totally throw off any realignment job once the boat's relaunched and assumes her characteristic waterborne shape.

As you survey the damage in the company of a few listless wharf rats (who are hanging around because they dig tragedy), a yard foreman walks up. He shakes his head pityingly, recognizing at a glance that he's looking at a pile of money here. For starters, in addition to the props, both of your boat's mangled prop shafts will need to be uncoupled from the engines, extracted from the stern tubes, and sent to a machine shop or prop shop. There they'll be examined visually and with the aid of various chemical compounds and dyes to assure there are no hairline cracks or breaks, perhaps in way of a shaft barrel or prop hub, where the

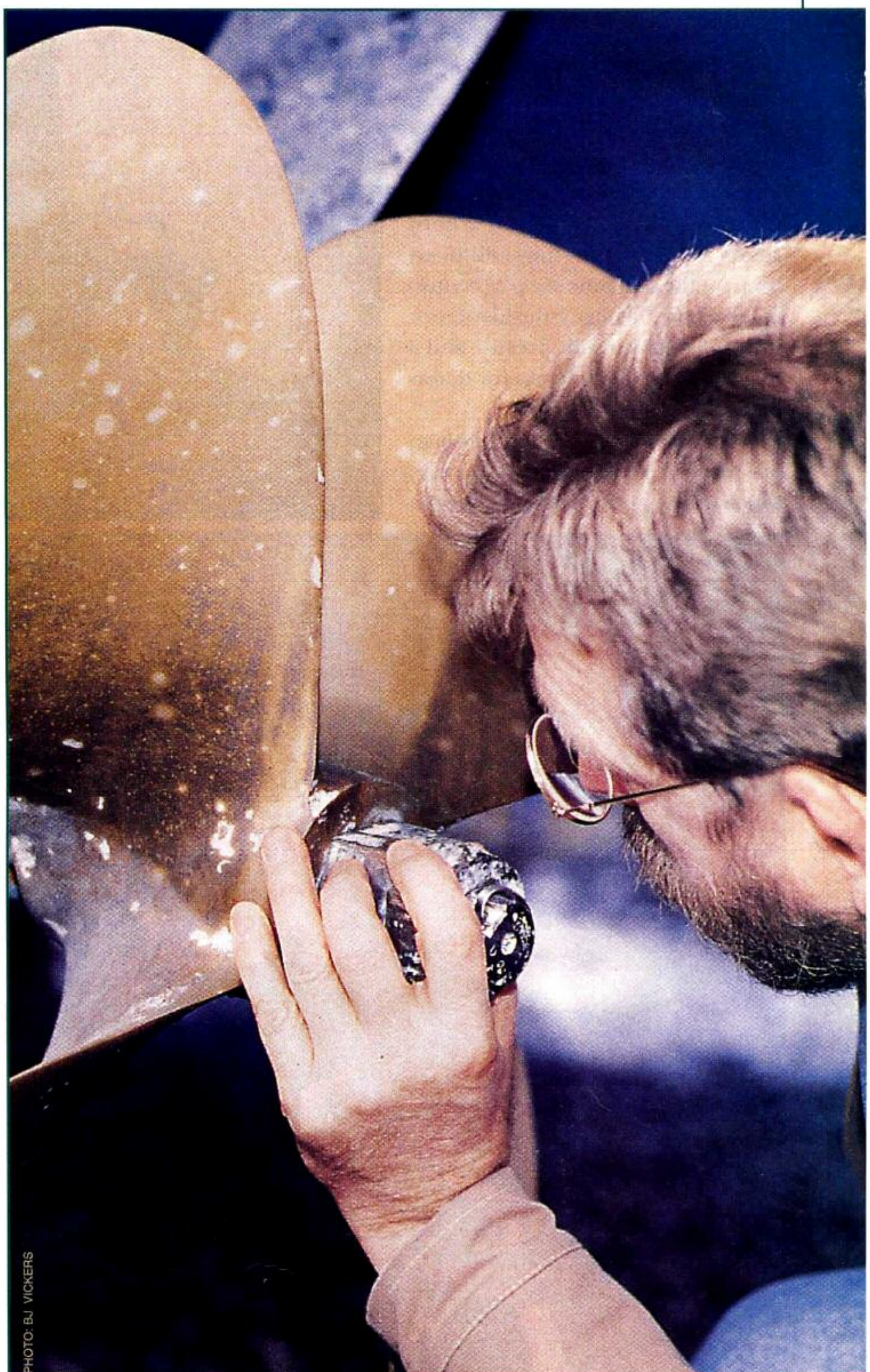
PHOTO: BJ VICKERS

A straightened prop shaft, eyeball expertise, and plenty of experience are needed to perform an accurate sighting via the old-fashioned method, simulated above by the author.

Expensive instrumentation for optical and laser sighting methods are virtually identical, although the optical device (right) is less fragile, demanding, and costly than laser equipment.

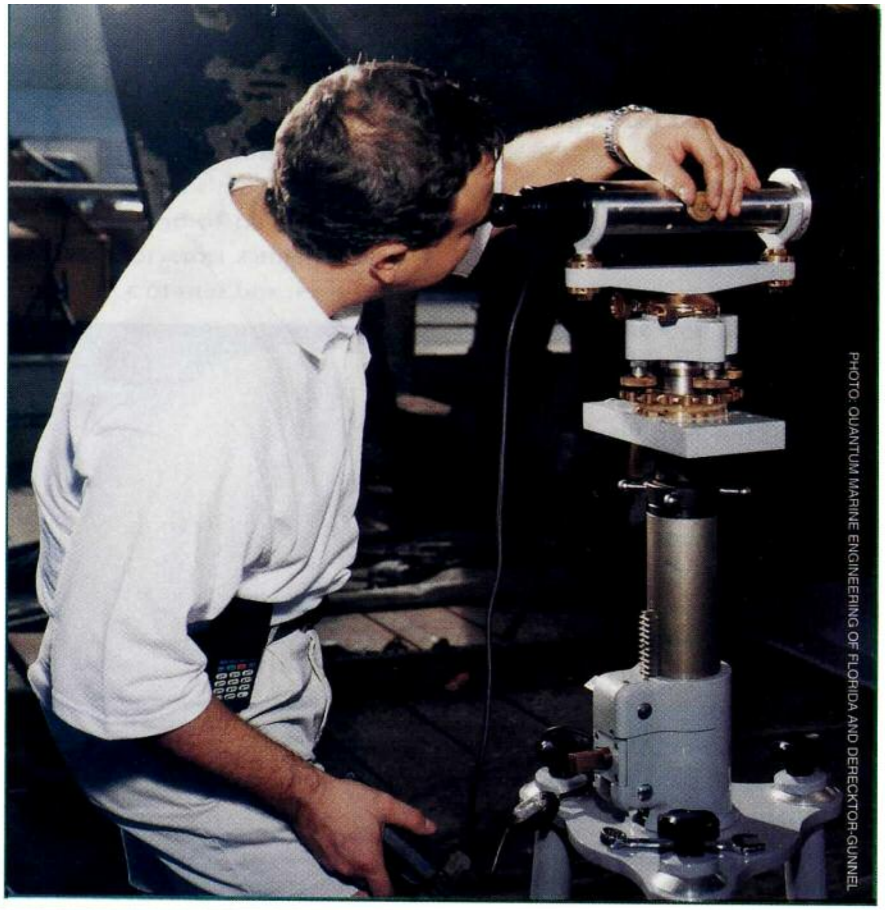

PHOTO: QUANTUM MARINE ENGINEERING OF FLORIDA AND DERECKTOR-GUNNEL

keyway and shaft taper weaken the overall structure.

Other issues beckon. The rudders must be checked for damage and, if necessary, pulled and dispatched to a machine shop for closer inspection and possibly repair. If a prop shaft is cracked or broken, a replacement must be ordered, and even if both shafts are fine, they may still need time on the machine shop's "centering machine," a huge lathe-like device with rollers, hydraulic presses, and a dial indicator that checks for deformation.

Only after all this does the foreman schedule a realignment sighting, which will be performed either by the yard itself or by an outside firm. In either case the goal is the same: determining *exactly* where the new or repaired struts should be repositioned to ensure the prop shafts turn smoothly. There's a simple reason for the almost exclusive concern with the struts: No other part of the running-gear system is so easy to reposition.

Of course the foreman will choose from among the four basic realignment sighting techniques based on his yard's capabilities and, if you're a savvy owner, your input. So here's a brief rundown on the foursome.

Let's start with the "old-fashioned" method that's characteristic of small mom-and-pop yards. Its essence is pure ingenuity and involves simply returning the straightened and rehabbed shafts to their stern tubes, coupling them to the marine gears, and then using them as realignment tools to position the struts.

While the technique is relatively fast and cheap, it has a couple of

PHOTO: ROBERT HOLLAND

Despite the importance of wire and calipers, a precise piano-wire sighting still entails considerable artistry and steady-handed experience.

drawbacks. First, old-fashioned artistry calls for a *lot* of intuition and experience. Second, long prop shafts are not really straight enough to produce truly accurate realignments; they droop in unsupported areas, like between shaft logs and reverse-gear output flanges.

A more precise approach is also the most popular technique used today, at least for boats like *Seafarer* less than about 70 feet. Called the "piano wire method," it replaces eyeball artistry with a couple of guys bearing simple tools, basically a $2.50 piece of piano wire, a pair of calipers, and a 20-pound weight. Working on one drive train at a time, they center and fasten one end of the wire to the marine gear output flange and snake the remainder of the wire through the

With either optical or laser methods, optical or photoelectric targets are positioned throughout the drive train, starting with the reverse-gear flange. It is similar to the way you sight a rifle.

shaft log, stern tube, and strut barrel. Next they attach the weight to the aft end of the wire and drape the wire over a fulcrum-like tail piece temporarily mounted on the rudder, swim platform, or whatever's handy. Again, since struts are the most easily moved part of the running gear, the piano-wire process focuses on them. Finally, using calipers and an adjustable feature of the tail piece, the technicians center the taut wire in the after opening of the strut barrel, then check where the wire is in the forward opening of the strut. If it's also not centered there, they know the strut is out of whack. Then they will figure out with caliper measurements how to fix the problem.

For all the skill and experience needed to do a piano-wire sighting right, it is pretty inexpensive. According to Don Wakesman of High Seas Yacht Services of Pompano Beach, Florida, a company that routinely does piano-wire sightings, a job on a boat like *Seafarer* typically runs about $400.

The two remaining realignment techniques are a lot alike. The more popular of the pair, the "optical method," has been used for many years in commercial and military ship construction and costs a good deal more than the piano wire technique. According to John Allen of Quantum Marine Engineering of Fort Lauderdale, a company that performs optical sights on megayachts all over the country, a sighting on a badly damaged vessel of *Seafarer*'s size will cost an owner between $800 and $1,000.

The optical technique is straightforward in theory. After a transit-like "scope" is approximately positioned on the shaft line, targets are inserted into strut barrels and other openings, and a reflective target is placed on the marine gear output flange. The rest is like sighting a rifle. Since targets can be individually lighted, focused, and measured, offsets for proper realignment are simply read off the instrument. The big advantage of the optical method, according to Allen, is that it works for extra-long shafts, over distances that would sag a piano wire no matter how much weight you applied to make it taut.

Although the "laser method" is theoretically as straightforward as the optical method, it's more esoteric in practice. A delicate electronic device replaces rifle-sight mechanics with a laser beam and optical targets with photoelectric cells. Because the equipment involved is operationally demanding, delicate, and costly, this method is typically used only on large yachts. However, in the unlikely event that a laser sighting were performed on a boat of *Seafarer*'s ilk, the cost would be about the same as an optical sighting, says Allen.

Heaven forbid you should run your boat aground, but in the event you do, bear in mind these rules of thumb. If your inboard-powered boat has relatively short shafts (less than 10 feet) and single struts, the eyeball method is fine. If your system is more complex, with prop shafts up to 24 feet long and as many as three sets of struts, the piano wire technique is your best bet. If your boat has complex running gear—say, a short stern tube, long shaft, and four or more sets of struts per side—opt for the added accuracy of the optical or laser methods. The more bearings, couplers, and flange surfaces, in other words, the more sophisticated the technique you should choose. And hey—next time, check your depthsounder *before* you jam those throttles into reverse. □