NEW IRON. *A pair of Cummins diesels for a classic Hatteras.*

POWER TRIP

Repowering with modern diesels can boost speed, increase efficiency and cut emissions.

BY CAPT. VINCENT DANIELLO
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An engine swap can breathe new life into an older boat, and thanks to ongoing advances in diesel technology, repowering may also make good economic sense. Over the past decade, diesels have become not only more reliable and run cleaner, but they've also picked up as much as a third more horsepower for a given size. For proof, look to the Cummins MerCruiser B-Series, which is a popular option for owners going from gas to diesel. The B-Series engines were rated at 370 hp from 1998 through 2003. In 2004, the electronically governed version bumped horsepower to 380 hp. In 2005, that same engine reached 425 hp, and in 2008 it hit 480 hp. Fuel economy has also increased markedly, enabling boats to go farther on each gallon of fuel and take considerably less time to do it. When your boat is both faster and more economical, that favorite weekend destination starts to look more like a day trip, and itineraries that once required four or five days become weekend getaways. Read on to meet a few owners who realized those benefits firsthand.

Mistress Makeover

When Bob and Sheryl Gaum bought their Silverton 402 new in 1998, they opted for 380 hp Crusader 502 8.2-liter gas engines. "The boat was always underpowered," Bob says. "I'd have to push the engines to the maximum cruising rpm to get 14 knots." Silverton did offer diesels, but in 1998 the 350 hp Caterpillar engines would have made the boat go only a few knots faster, cruising in the high teens and topping out at about 22 knots.

Last summer, the Gaums had enough. Their gas engines were tired and their cruising was suffering. "We looked for a new boat, but we couldn't find anything we

liked as well as our *Mistress*; that is, unless we wanted to jump to 53 or 54 feet," says Bob. "It was a lot cheaper to repower than to buy a new boat."

The Gaums replaced their aging gas motors with Yanmar diesels. Like Cummins, Yanmar has steadily increased the power of its midsize diesels. The 480 hp, six-cylinder LY3 electronic engines that now power *Mistress* to 29 knots were available with just 440 hp in 2005 and only 420 hp in 2001. The Gaums spent about $130,000 on the project — one-third of what a similar used boat with comparable diesels would cost and many times less than the new boat they would likely have bought. (The repower project also included a new hardtop, a larger diesel generator and a hydraulic dinghy lift.)

The new diesels have markedly changed the way the Gaums cruise on the Chesapeake Bay. "It used to take us three hours to go to Rock Hall [Maryland], and we wouldn't go unless we could stay overnight," says Bob. "Now we can make it in an hour and 45 minutes, so we go down just for the day. On longer trips, we don't like to cruise more than four or five hours per day. Now we can get a third farther in that time."

The Gaums typically cruise at about 22 knots, noticeably past the boat's planing point but well under the engines' cruising rpm. Each engine burns less than 15 gallons of diesel per hour, down from nearly 18 gallons of gasoline each of the old motors consumed at 14 knots. "I gained 8 knots and saved six gallons per hour at a lower cost per gallon," Bob says. He also appreciates having more speed in reserve. "On the way back from St. Michaels [Maryland] a few weeks ago, a big storm developed," he says. "We were able to kick it up to 24 or 25 knots and make it in before the storm hit. With the old engines, we would have been coming home in lightning."

Should I Repower?

- If you can't find a better boat than the one you own, new engines could rekindle the spark with a boat you obviously love.
- Most systems run through the engine room at some point, so if you are serious about a repower, know that it is a good time to upgrade other components. Get a sense of what has to fit and what it will cost before the project begins.
- A tight budget or a tight schedule makes large projects difficult. If you're on both, a repower probably isn't a good idea.
- Cost is only half the concern. Are you ready for major surgery on your beloved boat?
- Bigger engines need more air, requiring larger hull-side vents. Fuel tanks should be tested and possibly replaced. Engine stringers and major bulkheads have to handle the added horsepower.
- A modest increase in horsepower may be achieved with the same running gear, slightly thicker shafts and larger props, but bigger increases might call for new underwater metal. Increasing speed to over 30 knots may require flatter propeller shaft angles, which adds to the cost, and propeller pockets, which could kill the deal.

AIR IT OUT. *Large hull-side vents into* **Lady Linda***'s engine room provide air for the new engines' increased horsepower but keep seawater out.*

Bob also finds that the added weight of the diesels — and the boat's new, fully planed running angle — significantly enhance the boat's comfort in a sea. The larger propellers make the boat more responsive when docking. "When I kick it up over 26 knots, the whole boat comes up out of the water," Bob says. "It's like a runabout."

The Gaums credit the success of the project to the experience and dedication of the crew at Down Jersey Marine in Greenwich, New Jersey. "One company gave me a cheaper price, but it wanted to put the exhausts out the side of the boat," says Bob. "That would have been terrible. One of the reasons I went with Tim [Silvio] was because he understood I wanted to do it right."

Tim Silvio, owner of Down Jersey Marine and the hands-on project manager for repowers, says increasing the exhausts from 5- to 6-inch diameter was a difficult part of this specific job. "Going out the side would have been a lot easier than what we had to do, but blowing exhaust out the side makes no sense," says Silvio. "It's an easy way out." Silvio's crew removed and replaced the boat's fuel tanks and much of the aft stateroom cabinetry to access the exhausts and make them larger. He says his crew's ability to handle all aspects of the job, from fiberglass work to metal fabrication, helped him stay on time and on budget.

But like the exhausts on the Gaums' boat, every project has its difficulties. Says Silvio, "You have to be able to work

with the owner and say, 'On some of this stuff, I can't give you an exact quote.' There has to be some trust there."

Silvio also credits *Mistress*' enhanced performance and handling to careful engineering. "This isn't just the nuts and bolts," he says. "It's a huge engineering project. You have to do the homework or the project isn't going to come out right. The key is picking the right engine, the right gear package and the right reduction, shafts and props. That's where a lot of people get into trouble." According to this repowering expert, *Mistress*' ride and "feel" was enhanced with bigger propellers turned at a slower speed. "We put on 24-inch wheels, which lift the stern and keep it on plane at a lower speed," Silvio says.

Time for a Change

With so much more horsepower available today, repowering makes sense on older diesel boats too. Doug Cardente and his wife, Linda, purchased their 1981 Hatteras 50 at the Fort Lauderdale Boat Show in 1998. "It's been the family boat for 10 years," Doug says. "We've got one log full and now we're working on a second. We've had a lot of fun aboard."

Not long ago, this couple started looking at new boats, particularly those built in their home state of Maine. Yet the Down East-style models, although beautiful, didn't have quite enough room inside. "The Hatteras has so much interior space," says Doug. "We can get six people in nice accommodations. Plus, the cost to replace *Lady Linda* would have been over $1 million. We already owned our boat. We realized we could have a pretty nice boat for a couple hundred thousand dollars or take a beating on the trade-in."

The Cardentes didn't want their boat to run as fast as a tournament battlewagon, but the Hatteras' original 550 hp 8V92 Detroit Diesels were showing their age. "The engines were tired," says Doug. "It was smoking out the starboard engine quite a bit. It was embarrassing." His initial plan was to overhaul the Detroits. He says: "You hear figures of $2,000 to $3,000 per cylinder, but then you add the turbos, all the miscellaneous items, and the quote keeps getting higher. When you add it up, the total package was over $70,000." The Cardentes had another option.

HOT WHEELS. *ZF's high-tech Faster Propellers' progressive pitch and airfoil shape squeeze another 5 percent or more from each drop of fuel.*

How Much Fuel Will I Save?

Bob Gaum reported his fuel costs for a recent 45-mile trip from Georgetown, Maryland, to Annapolis on his Silverton 402 (see chart). With his old Crusaders, the trip took three hours and used 105 gallons of gasoline, $3 per gallon at his fuel dock. With the new Yanmars, he made the trip in about two hours and burned 60 gallons of diesel at $2.45. While this is a best-case scenario, Gaum has cut his fuel bill in half while traveling almost 50 percent faster, saving over $3.50 per mile.

SILVERTON 402: BEFORE AND AFTER

Original Power: (2) 380 hp Crusader 502 gas engines

RPM	KNOTS	GPH
1,000	6.1	4
1,500	7.9	6
2,000	8.4	10
2,500	9.2	16
3,000	15.8	20
3,500	19.9	29
4,000	24.4	48
4,600	27.3	72

Repowered: (2) 480 hp Yanmar LY3 diesel engines

RPM	KNOTS	GPH
1,200	7.6	2
1,500	9.7	4
1,800	10.0	10
2,100	10.5	18
2,400	15.4	22
2,700	19.5	26
3,000	23.8	34
3,425	29.5	45

Gasoline engine tests were of a new sister ship with full fuel and water but only minimal equipment. Diesel tests of *Mistress* included a new hardtop, bigger generator and dinghy with hydraulic transom lift, adding about 1,900 pounds to the boat, plus full fuel, full water, owner's equipment and provisions for a weekend cruise.

They could have increased the existing engines to 725 hp for $50,000 per engine, but repowering made more sense for them. "I was going to put tens of thousands of dollars into old technology," Doug says. "This boat was built in 1981, but that technology wasn't new at the time."

Reliability was important to the Cardentes. "It's not that we were expecting trouble, but things were tired," says Doug. "Think about all the things you get with a repower. It's not just a new engine, but new transmissions, new hoses, a new starter and alternator. Those 1981 wiring harnesses were getting old." All the items Doug listed were replaced when the Cardentes decided to install new Cummins 715 hp QSM-11 diesels. With the old engines out, they were able to remove *Lady Linda*'s copper fuel lines and change the batteries. (Older Hatterases are wired for 32-volt equipment, which is hard to find today. Most of the boat was updated to 12-volt systems.) "With the engines out, you can really see everything and make sure everything is just right," says Doug. "It costs more, but you know [what you have]."

Ron Jago, the professional captain and boatbuilder who oversaw the Cardentes' project, takes a whole-boat approach to a repowering. "The average diesel guy doesn't want to touch a bilge pump or the steering gear," Jago says. His company, Unlimited Yacht Services in Palmetto, Florida, works on all on-board systems, most of which run at least partially through a normally cramped engine room. "We look at hoses, bonding wires, electrical systems and the pressure-water systems," Jago says, "If the boat is worth

What About Pods?

Some boat owners may wonder if they can repower their existing boat with pod drives from Volvo (IPS) or Cummins MerCruiser Diesel (Zeus). Because pod propulsion systems both push and steer the boat, neither Volvo nor CMD currently support repowers with pods. "For Zeus, I start with a new hull and design the system into it," says Dan Burns, applications engineering manager for CMD. His concerns include placement of the drives for boat trim and control, as well as the structural integrity of the hull. "For an existing boat, first I'd have to do my analysis [of the boat], then do the demolition, then start where I would have been with a new build," he says. "Could I do it? Yes. Could I do it economically? Not really."

In addition, the owner who repowered with pod drives wouldn't be able to take advantage of the extra interior room gained on a typical installation. "[With pod drives] I can pick up an additional stateroom in a 42-footer, but that's not something you can really do on a repower," says Burns.

CMD does offer Axius, which provides the dockside handling characteristics of pods in stern-drive boats and can be retrofitted. But for the foreseeable future, if you want inboard IPS or Zeus drives, it's time for a new boat.

doing the repower, it's worth checking everything else."

Jago says most repower clients are experienced boaters. Some recently purchased a boat, but know what the boat will likely need based on the survey. Others have owned a boat for a while. "Doug owned that boat for 10 years," he says. "Guys like him know what they have. A lot of the issues we find are already in the back of their minds."

Lady Linda avoided most problems typically encountered during a repower, like weak engine stringers or soft structural bulkheads. The running gear stayed largely intact. Even the exhausts (the major issue on *Mistress*' repower) actually went from 10-inch diameter on the Detroits to 8-inch for the new Cummins, so all changes were within the engine room. Still, other systems upgrades crept in. Jago estimates that of the total bill — just over $200,000 — between 10 and 15 percent went to projects not directly related to the repower. But the Cardentes didn't mind. "If it took a little bit longer or a little more money, [the investment] is coming back to me now," says Doug. "I no longer worry about what might break next or if the parts will be available." In fact, through the project, Jago and Doug have become friends. Says Jago: "Now I can go fishing with him without bringing my toolbox."

The old Detroit Diesels worked hard to push *Lady Linda* to an 18-knot cruise. With the new Cummins engines, the boat tops out near 27 knots and cruises at 22 knots. The Cardentes cruise the boat at 20 knots with the engines turning 2,050 rpm — just 65 percent load and considerably less than the maximum 2,330 rpm. The new engines also reduce the boat's weight by just over a ton, which didn't alter the 65,000-pound boat's trim noticeably. However, lighter weight and added muscle altered the boat's personality. "It's not just that the boat goes faster or performs better, which it does," Doug says. "It's always been comfortable, but having that extra 2 knots puts it at a better running speed. Before, it was right on the edge. Now, the bow is down a bit more than it used to be. At 20 knots, the boat feels great in the water. It's much more responsive. It's also nice to know you've got more left in case you need it."

A Formula for Change

Matching engines to a boat isn't as easy as picking a pair that fit the compartment. Factors such as hull shape and weight, propeller shaft angle and more determine just how fast an old hull should be driven. Fortunately, diesel engine manufacturers have recognized repowering as an important market. "We've got several great engines for boats in the 35- to 55-foot size range with the QSB, QSC and QSM and even QSL engines," says Dan Burns, applications engineering manager for Cummins MerCruiser Diesel. "We might go with the same size engine and drastically increase horsepower or use the same power but drastically reduce weight or do something in between. My group in Charleston [South Carolina] provides the tools and information our dealers need. We empower the dealer to work with the boat owner to determine which engine best suits his needs."

CMD also offers many ways to alter an engine's mounting footprint as well as exhaust and cooling system configurations. "It's not a truly custom engine, but the installer can build an engine that suits the project," Burns says. "He doesn't have to get creative. We've come up with those solutions, and they carry full warranties."

Yanmar, too, aggressively goes after the repower market with an equally wide selection of power options. Mastry Engine Center, the South Florida distributor for Yanmar, recently repowered a 1984 Hatteras 52 with eight-cylinder, 900 hp diesels, which now top out at just over 30 knots.

Why have engines become so much more powerful recently? According to Burns, modern fuel systems and turbocharger technology aided the increase, but he also credits computer design and manufacturing. "Common-rail [fuel delivery system] has been around since the 1930s, but

SUPPLY SIDE. *New fuel filters and supply lines go in before the new engines.*

EXTREME MAKEOVER. Lady Linda's *dated helm (top left) is filled and painted and then fitted with new Cummins MerCruiser Diesel SmartCraft electronic gauges and Digital Throttle and Shift controls. This 1981 Hatteras 50 was repowered with Cummins QSM-11 diesels.*

manufacturing techniques that just came about in the 1990s have allowed us to build on it," says Burns.

New technology from Cummins increased the Cardentes' enjoyment of their boat in ways they didn't anticipate. "On a long run [with the old engines], the stern would be covered in soot," says Doug. "It would be in the cockpit and on the chairs. Now there is nothing." The smaller, in-line, six-cylinder engines, with just one exhaust outlet per engine instead of the two on the V-8 Detroits, also made *Lady Linda*'s engine room seem much larger. And increased engine room insulation keeps the salon both quieter and cooler. Doug also appreciates his new dash, with all traces of his previous engine erased. "The old gauges weren't accurate anymore," he says. "I had little marks to show me what was normal. Now I have the electronic gauges. The new system monitors everything so closely; it will let you know if anything is wrong at all."

Bob also appreciates the *Mistress*' electronic controls and gauges more than he expected. "It's nice to see the fuel burn," he says. "I found that by dropping from 2,800 to 2,700 rpm I only lose a half a knot, but I save a gallon and a half [of fuel] per hour."

As with most repowers, the money spent on *Mistress* and *Lady Linda* won't be fully recovered when the boat is sold. "These boats with gas engines are going for $150,000 to $160,000," says Bob. "I have $270,000 in [the refit], and the boat appraised at just over $300,000." Still, he says he considers the refit money well-spent: "We enjoy the boat much more. It's faster, it rides better and we're spending less on fuel. With the extra speed, when we cruise for the weekend, we can stay longer and still get back. Plus, we don't have to watch the clock as closely."

The Cardentes also say the choice to repower was not about the resale value, but rather a question of the money spent versus the enjoyment gained. With renewed confidence in the boat, Doug, who cruised mostly in Florida and the Bahamas in the past, is setting his sights farther. "We're going all the way to Nova Scotia — over 1,500 miles," he says. "I wouldn't have been comfortable doing that with the old engines."

RESOURCES

Cummins MerCruiser Diesel, cmdmarine.com
Down Jersey Marine, downjerseymarine@verizon.net
Mastry Engine Center, mastry.com
Unlimited Yacht Services, unlimitedyachtservices.com
Volvo Penta, volvo.com/volvopenta
Yanmar, yanmar.com