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Propulsion test: inboard, sterndrive, jet

Our powerboat guru pays a visit to Hunt Yachts to test power options on its new 25-foot center console

I recently spent two days running four different Hunt 25 Center Consoles, all with different power. It was a great opportunity to see, feel and measure the effects that different drives and engines have on nearly identical hulls.

ON POWERBOATS

ERIC SORENSEN



The four propulsion setups were a 300-hp Volvo D4 diesel with Duoprop sterndrive; an inboard with the same engine and a smooth-as-silk five-blade ZF propeller;

sort of whoosh into the next wave — lots of vertical motion, as with any boat in these conditions, but none of the jarring or pounding you feel on the majority of boats of this size or, in fact, much larger.

Taking turns

A word on high-speed maneuvering: For our high-speed turn tests, we started off at 3,000 rpm making about 30 knots, then put the wheel hard over and kept it there for three or four 360-degree turns. (We timed a 720-degree turn, then divided by two to halve the stop-watch error.) Even during this hard high-speed turn, heel never exceeded around 20 degrees. It was just the right amount of heel for the turn rate, which means you feel the centrifugal force right down

secure — and a lot of fun to drive — in a high-speed maneuver.

Keep in mind when reading each sea trial report that the accompanying speed, time to turn, and acceleration numbers vary depending on who's driving the boat and recording the data, boat displacement, sea state and hull bottom condition.

The hull

What separates Hunt hulls from almost all of the rest on the market today is that the deadrise continuously changes starting at the transom, which typically has 20 or 21 degrees of deadrise. Basically, the chines run uphill starting at the stern, so deadrise in the middle of the boat (Station 5) is more than it is on an or-

The author tested four different propulsion setups on four Hunt 25 Center Consoles.



another Volvo sterndrive with a 375-hp 8.1-liter gas engine; and a Yanmar 315 driving an Ultrajet waterjet.

I tested the four boats for several hours each over the two days, and to my mind the 25 is one of the most seakindly, best-mannered, smooth- and dry-running vessels I've encountered. And true to its Hunt pedigree, the hull is quite rough-water capable. Here's the skinny on how these warped-vee hulls (more on that later) performed.

I ran all four at 30 knots into 2- to 3-footers on Rhode Island's Narragansett Bay. They were smooth, comfortable and straight-tracking — and dry as a bone at 25 knots in a beam wind. I spend a lot of time on many different boats, and very few 25-footers can run at 30 knots so comfortably into these seas. They just

through your feet, rather than being thrown outboard or inboard. Volvo even has a buzzword for this balanced heel-versus-turn rate, a "true turn," which when you think about it works as well as anything.

The Hunt hulls I've run, regardless of propulsion, all have this characteristic, and it makes for a safer, more enjoyable platform to ride on. Some other stern-drives (and outboards) have a tendency to heel excessively or even skid out in a hard turn, and that loss of dynamic stability is both disconcerting and potentially dangerous.

The Hunt boats have the proper hull shape, with just the right recipe of chine width and down-angle, bottom deadrise, keel radius (roundness in cross section) and vertical center of gravity to make it safe and

dinary monohedron deep-vee, even with its greater transom deadrise of about 24 degrees.

This means the 20- to 45-knot warped-vee Hunt bottom will have a smoother ride than the average monohedron, which carries its transom deadrise forward to the middle of the hull, making it flatter where most wave impact takes place. Also, the Hunt's natural sweet spot on plane is in the region most people actually run their boats — 20 to 35 knots — while a conventional constant-deadrise deep-vee typically comes into its own at 40-plus knots.

If you're looking for an 80- to 100-mph offshore racing monohull, get yourself a conventional deep-vee, since they spend a lot of time hopping from wave-top to wave-top and landing stern first. For the rest of us

BILLY BLACK

loafing along at 30 or 40 knots, the warped running surface is smoother, dryer and easier to get on plane. With its lower running angle, visibility over the bow is better, the ride is smoother in a head sea, and, thanks to its longer on-plane waterline, dynamic longitudinal stability is improved. This last point is one of the reasons the Hunt bottom can handle a variety of propulsion types successfully; it's more tolerant of varying longitudinal centers of gravity (LCG) and propeller thrust lines.

But don't take just my word for the smooth ride; sea trial a hull designed by C. Raymond Hunt Associates, the New Bedford, Mass., naval architecture firm named after its pioneering founder. But first a word of advice: don't waste your time in calm water. Take it out when the wind is blowing hard. There are a number of manufacturers building hulls designed by Hunt Associates. All Grady-Whites have Hunt hulls. You can try a Grand Banks Eastbay, one of the bigger Four Winns, a Chris-Craft Roamer 40, Wellcraft 360 Coastal, Global 68, a Southport or any of the high-end Alden yachts. Or hitch a ride on any number of pilot

(From top) The helm is ergonomically laid out, and there's good access to the engine, mounted beneath the helm seat module. Overall draft is no deeper than the hull draft with the waterjet setup. The inboard's curved ventilation plate prevents the aft-mounted rudder from stalling.

pers. This lets you replace the fuel tanks in a few hours — or the entire drivetrain, if necessary.

A transom seat lifts out if you need more fishing room, making the cockpit versatile and family friendly. The large center console has a compartment that sports a marine head, shower, sink and 72 inches of headroom.

The helm is ergonomically laid out, with the wheel and throttle comfortably positioned and angled at just the right height. The electronics flat is up high for easy viewing, and the engine gauges are down where they can still be seen, while allowing prominence of place for the GPS/plotter and radar. The boat is well-equipped for fishing, with a bait well, fishbox, and plenty of rod holders and rod racks.



boats or maybe a large custom yacht from Palmer Johnson. The important thing is to take one offshore and then buy the one with the layout you like best.

25 CC layout

Regardless of the drivetrain, the engine in the Hunt 25 Center Console is mounted in the center of the cockpit, forward of the transom, shifting the center of gravity forward when compared to transom-mounted power. It's connected to the sterndrive or waterjet by a short jackshaft and, with in-line inboard power, directly to the propeller shaft. The cockpit deck lifts out, fastened around its perimeter with screws, and the deck flange mates to a gutter that drains and channels water quickly aft and out through the scup-

Along with a choice of propulsion, Hunt lets you pick hull and deck colors (bring a paint chip from a local hardware store) and offers a variety of upholstery fabrics and teak options, including washboards aft and toerails forward. The overall result is a custom-looking boat without the custom pricing.

A little history

Ten years ago, C. Raymond Hunt Associates decided to dip its toe into the boatbuilding business. "We'd been designing them for years for other boatbuilders, the government and commercial users," says John Deknatel, the firm's president. "So we figured why not build a few of our own as well."

See Propulsion Test, Page 56

ERIC SORENSEN (4 RIGHT)

THE SEA TRIALS

Volvo D4 300-hp diesel sterndrive

The diesel sterndrive is the way to go if you're looking for the ultimate in range (more than 300 nautical miles at cruise with a 10 percent reserve, and that's with a mere 100-gallon fuel capacity), economy and responsive handling, both dock-side and at speed. The inboard and waterjet just can't compete with the Volvo Duoprop's efficiency, acceleration and directional control.

This boat readily backs downwind at idle in either direction, turns in about two boat lengths at high speed, and accelerates strongly. The power steering allowed fingertip control, and it was very responsive at just three-and-a-third turns from lock-to-lock. The only annoying thing was the distinct clunk when shifting into gear.

If range is your first priority, then the diesel sterndrive is the best pick, at least at high cruise speeds, since the diesel inboard offers better economy at speeds up to 20 knots. At 7 knots, the diesel inboard gets a whopping 6.5 nautical miles per gallon compared to 5.3 nmpg for the diesel I/O and 2.6 nmpg for the gas I/O and the diesel waterjet. At 20 knots, the diesel inboard still gets the best economy, while at 25 knots and above, the diesel sterndrive gets the nod, with the sterndrive's lower drag (compared to the inboard) coming into play. The waterjet doesn't compete efficiency-wise with either of the other diesels, though it beats the gas I/O hands down the faster you go above 23 knots.

Another thing to love about the diesel sterndrive is the electronic controls; they work so smoothly and easily that you have to be careful at first if you're used to mechanical controls. Neutral detent is just firm and noticeable enough to get your attention, and during our divisional tactics maneuvering, with the four boats in close formation, these controls were a real pleasure to operate.

Unlike the diesel inboard, the sterndrive's rpm dropped from 3,000 to 2,500 rpm in a hard turn. A full turn to port and starboard took essentially the same time: 10.3 seconds. That's fast, in case you haven't tried this at 25 to 30 knots, and a little more than half the time it took the inboard. Unlike the D4 inboard, the D4 stern-

drive started to accelerate hard right from 1,200 rpm, taking off like the DeLorean in the film "Back to the Future." Acceleration to plane was 5.7 seconds, 3 seconds faster than the inboard, and time to 20 knots was 7.3 seconds, almost 4 seconds faster than the inboard with the same engine.

The smaller-diameter sterndrive props have less inertia (like a smaller flywheel)

Volvo 375-hp gas sterndrive

Standard power in the Hunt 25 is the 375-hp Volvo Duoprop sterndrive. It offers excellent handling and the strongest acceleration on plane at just 5 seconds, lagging just a half-second behind the diesel sterndrive to 20 knots. This puts the diesel sterndrive's strong midrange performance in per-

diesels, which vibrate more at idle than they do at 1,000-plus rpm. At a 30-knot cruise, though, the diesel inboard was actually quieter — just 84 dBA compared to 86 dBA for both gas and diesel stern-drives — and the gas I/O was loudest of all at full power.

Range and economy don't compare with the two diesels. While the diesel



THE TEST LINEUP (from left): diesel waterjet, diesel sterndrive, gas sterndrive, diesel inboard.

for the diesel to overcome when spinning up, which, as Willard points out, is part of the reason for the stronger acceleration. And the props are more efficient, taking the twist out of the discharge race and directing all of the thrust aft rather than in a spiral.

Both Volvo D4 common-rail diesels ran essentially smoke-free, including when starting up cold at the dock and upon hard acceleration out on the water. They also are remarkably smooth vibration-wise, with sequential common-rail fuel injection and excellent mounts taking the credit.

spective, beating the gas-powered sterndrive to 20 knots, even if only by a whisker.

There are a number of good reasons for choosing a gas sterndrive over the diesel, including its lower price, higher top speed, and the quietest noise levels, at least at low speed: 65 dBA at 5 knots compared to 68 dBA for the diesel inboard and 70 dBA for the diesel sterndrive. Idling around the dock, the gas engine is also a lot smoother than the

fumes are barely noticeable, you know you're on a diesel boat when idling around. If you want to avoid any hint of diesel exhaust, go with the gas engine. While a gas engine won't last as long as a diesel, for most people it's academic. Most owners don't put more than 100 to 200 hours a year on their boats, so the 2,000 hour engine life that you could expect from a gas engine, given reasonable care, equates to many years of service.

Hunt 25 CC Volvo D4 300-hp sterndrive, 1.76:1 gear ratio, Ocean Series DP, G6 propset

RPM	Knots	MPH	GPH	SMPG	NMPG	SM Range	NM range	dBA
700	5.3	6.1	0.7	8.71	7.57	784	681	70
1000	6.9	7.9	1.3	6.10	5.31	549	478	75
1500	9.5	10.9	4	2.73	2.38	246	214	81
2000	16.8	19.3	4.7	4.11	3.57	370	322	85
2500	24.45	28.1	6.8	4.13	3.60	372	324	87
3000	30.9	35.5	9.9	3.59	3.12	323	281	86
3300	34.15	39.3	12	3.27	2.85	295	256	88
3550	37.7	43.4	15	2.89	2.51	260	226	89

30-knot turn
10.3 sec

time to plane
5.7 sec

time to 20 kts
7.3 sec

Hunt 25 CC Volvo DP gas 375-hp 8.1 liter, 1.78:1 gear ratio, Ocean Series sterndrive

RPM	Knots	MPH	GPH	SMPG	NMPG	SM Range	NM range	dBA
700	3.5	4.0	1.6	2.52	2.19	226	197	59
1000	5.7	6.6	2.3	2.85	2.48	257	223	68
1500	7.4	8.5	2.8	3.04	2.64	274	238	77
2000	11.2	12.9	5.1	2.53	2.20	227	198	84
2500	17.3	19.9	7.8	2.55	2.22	230	200	88
3000	20.4	23.5	10.1	2.32	2.02	209	182	87
3500	26.4	30.4	12.8	2.37	2.06	213	186	84
4000	30.8	35.4	18.2	1.95	1.69	175	152	86
4500	36.5	42.0	25.8	1.63	1.41	146	127	89
4750	38	43.7	32.2	1.36	1.18	122	106	90

30-knot turn
14/10 sec

time to plane
5 sec

time to 20 kts
7.8 sec

BILLY BLACK

A TRIALS THE SEA TRIALS

Yanmar 315/Ultrajet

Hunt likes the Yanmar 315 for its high power-to-weight ratio (dry, the engine weighs just 944 pounds) and chose the Ultrajet 251 propulsion unit in part because it is available with joystick control, which makes dockside handling a lot easier.

Like any waterjet in this class, the impeller cannot absorb much horsepower until the engine is turning close to its rated rpm. That means the boat starts to get on plane and seriously move at 3,300 rpm, just 600 rpm off the top. That's no fault of the boat or the drivetrain; it's just the physics of water flow through a small-diameter pump. But once the boat is up to 3,500 rpm, which the Yanmar can cruise at comfortably all day long, the Hunt 25 is making about 25 knots, and top end with 60 percent fuel, a clean bottom and two people aboard is about 31 knots.

This boat was headed to the Mediterranean for life as a tender aboard a megayacht, and jet power was chosen for its shoal draft, swimmer safety and maneuverability. (The boat was hauled for delivery before I had a chance to record time to plane, time to 20 knots, and 30-knot-turn data.) This is not the boat to buy if you want to cruise at 20 knots, go faster than anyone else, or are looking to squeeze every last mile out of a tank of fuel. However, it does what it does very well.

"Our jet customers find this propulsion to be very liberating," says Willard. "They don't have to worry so much about lobster pots or shallow water and, with a boat of this size, our owners take them right up to the beach for a picnic."

Of course, this is something you can actually do with a 25-footer drawing just 18 inches (hull draft), so it's a practical, useful capability in a boat of this size. Beaching a million-dollar 40-foot jet on a regular basis isn't something an owner is likely to do, so shoal draft opens up a new dimension operationally in a small boat like this. The impeller will ventilate more easily in rough water than a prop, so keep that in mind if you run far offshore often.

One thing quickly became apparent when running this boat down sea in the 2- to 3-foot Narragansett Bay chop — how well it tracks running with the waves. If you're in the market for a waterjet, the hull form will make the boat sink or swim handling-wise. The Hunt has enough deadrise and the proper center of gravity to give it just the right amount of directional stability. If it's too flat aft, the boat will fishtail so much you'll never be able to

take your hands off the wheel. And it will spin out in a turn, which is dangerous for the occupants. Too much deadrise and the boat won't be able to get out of its own way, struggling to get up on plane.

The Hunt design also includes a fairly fine bow with high chines for a smooth head-sea ride, but not so deep or fine that it bow-steers running down sea. The result is a hydrodynamically well-balanced hull. (A few other popular specialty jetboats I've run are anything but.)

Our jetboat's steering had a very quick single turn from lock-to-lock, so that takes some getting used to. Absent a rudder or lower unit, the waterjet-powered boat tends to wander, so the tendency is to oversteer until you get the hang of it. By the time I was done driving the boat for a few hours, the steering ratio seemed about right.



Heel never exceeded around 20 degrees in the high-speed turn tests.

Dockside, the Ultrajet joystick worked like a charm. In normal maneuvering mode around the dock, just push the stick to the side to steer in that direction. There's also a "backing" mode, which is best used when you're facing astern. When you push the stick to port, so goes the stern. When backing down in normal "ahead" mode, the stern would go in the opposite direction, because of the way water is deflected off the reversing bucket.

With any jet, you can also leave the engine in gear — turning the impeller — and drop the bucket from any speed to deflect thrust forward and stop the boat on a dime. Of course, this is also a safety advantage if you see something ahead at the last moment.

Volvo D4 300-hp diesel inboard

This boat stands out for its smooth drivetrain, with low vibrations from a fast idle on up and none of the gear chatter or whine of the sterndrive. It's a very quiet package; the sound of the waves slapping the hull at speed are as noticeable as the engine exhaust. The builder has done a good job isolating radiated noise through the engine box and deck, with exhaust noise — as low as it is — predominating.

Steering at speed was crisp and responsive at just four turns from lock-to-lock. The boat didn't have power steering, but the rudder is well-balanced, minimizing steering effort. A 360-degree, 30-knot turn took 20 seconds to port and 18.5 seconds to starboard — very good time for an inboard, which deflects, rather than redirects, prop thrust.

transom, though, with no lower unit or entrained waterjet, so center of gravity is a little farther forward on this boat.

Combined with the shaft angle's tendency to push the bow down at high speed, the boat runs at just 2 or 3 degrees of trim, and there's no lower unit to trim the bow up to increase speed. This slows the boat a tad with the increased wetted bottom area, which accounts to some degree for the inboard's lower top end compared to the D4-powered sterndrive. The sterndrive is also more slippery under water, and its counter-rotating props are more efficient, which accounts for the rest of the difference. That said, the 3.6-knot top end difference is less than one might expect, and the 3,000 rpm cruise difference drops to 2.6 knots, though the sterndrive's efficiency is markedly better, as we'll discuss.

Dockside, the inboard's turning circle is much wider than the sterndrive's, though it really doesn't matter as much with the bow thruster option. The rudder is big enough to steer astern fairly effectively. The trick is to gun it to gain sternway, then back off on the throttle to an idle, lessening the prop's side force and allowing the rudder to dig in. This boat will back and fill as well as any high-speed inboard of its size when working in close quarters. When put in gear, response is instantaneous; in about 3 seconds, the boat is doing 5 knots, with the big ZF 5-blade prop quickly gaining traction.

So why buy the inboard diesel? It's the ultimate in simplicity and reliability, and it's noticeably quieter than the sterndrives — including, believe it or not, the gas sterndrive — when running at speed. And fuel economy is much better than the gas sterndrive or diesel waterjet. Also, with the electronically controlled Volvo diesel, rpm doesn't drop off in a turn. I was impressed with the inboard's performance overall, especially its low noise (though it clunks when shifting like the diesel sterndrive), vibe levels, and responsiveness to the throttle and wheel at speed. Just don't expect the maneuverability or high-speed efficiency of the sterndrive.

Hunt 25 CC 315 Yanmar Ultrajet 251, 4 POB, 60% fuel

RPM	Knots	MPH	GPH	SMPG	NMPG	SM Range	NM range	dBA
700			0.2					
1000	3.6		0.5				69	
1500	5.3		1.6				77	
2000	7	8.1	2.7	3.0	2.6	268	233	81
2500	8.3	9.5	4.8	2.0	1.7	179	156	84
2800	10.3	11.8	6.4	1.9	1.6	167	145	86
3000	11.4	13.1	7.6	1.7	1.5	155	135	88
3300	19.4	22.3	10.7	2.1	1.8	188	163	88
3500	24.8	28.5	12.8	2.2	1.9	201	174	88
3900	30.8	35.4	16.9	2.1	1.8	189	164	89

Hunt 25 CC Volvo D4 300-hp inboard, 5-blade 19 X 27.5 ZF propeller, 2:1 gear ratio

RPM	Knots	MPH	GPH	SMPG	NMPG	SM Range	NM range	dBA
700	5.1	5.9	0.6	9.78	8.50	880	765	68
1000	7.2	8.3	1.1	7.53	6.55	677	589	73
1500	8.4	9.7	3.05	3.17	2.75	285	248	78
2000	15.5	17.8	4.4	4.05	3.52	365	317	80
2500	22.6	26.0	6.2	4.19	3.65	377	328	83
3000	28.3	32.5	9.5	3.43	2.98	308	268	84
3300	31.1	35.8	12	2.98	2.59	268	233	85
3650	34.1	39.2	14.5	2.70	2.35	243	212	86

30-knot turn
20/18 sec

time to plane
8.7 sec

time to 20 kts
11 sec



Sorensen says the warped-vee Hunt hull is smoother, dryer and easier to get on plane than a conventional deep-vee.

PROPULSION TEST from Page 53

Winn Willard, vice president of Hunt Associates, took the lead in establishing the boat company, bringing in Peter Van Lancker to run it while staying on as CEO. Van Lancker, hard-charging and multitasking, built boats for 30 years at such companies as Boston Whaler, Black Watch and Chris-Craft and, in fact, oversaw Chris-Craft's resurrection and transformation before parent Outboard Marine Corp. went belly-up. Ray Hunt, C. Raymond's grandson, heads up engineering, and it's obvious the apple hasn't fallen far from the tree. A deep understanding of how boats work is the creative force at the company, which is based in Middletown, R.I.

look at how the Hunt 25 is built. A layer of mat wet out in vinylester resin is laid down over the gelcoat. This premium resin-saturated laminate prevents blistering and minimizes or eliminates the crazing and cracking sometimes seen in more brittle resins. Only knit reinforcements are used in the hull and decks (no woven roving), and the hull support structure is supported by fiberglass-encapsulated, foam-cored stringers for stiffness, strength and moderate weight.

The bottom is solid glass, while the structural bulkheads and vacuum-bagged hull sides are foam-cored to create stiff, lightweight panels. The transom is cored with a 2-inch high-density foam called Penske board, which resists compression from the lower unit

sources. In my opinion, the construction is as good, or better, than most production boats on the market today, producing a reliable, durable boat.

Conclusions

The 25 CC was designed from the outset for running very well with stern-drive, inboard or waterjet power — a unique offering in today's powerboat market. Hunt is able to specialize in this niche precisely because it has the expertise to pull it off.

The Hunt 25 is a good boat for people who like choices. You can choose your power. You can choose how the boat looks and is equipped. Other than high-end custom builders, few other manufacturers offer such a range of propulsion options and encourage you to put your personal signature everywhere on board.

"We found that right from the start 10 years ago, our customers were attracted by the Hunt ride and the ability to really individualize their boat," says Van Lancker. "Many of our owners have owned a number of boats and know just what they're looking for, while others tell us how they spend their time on the water and look to us for guidance. Either way, we get a lot of satisfaction out of working with our customers to help them personalize their boats. The right answer around here more often than not is, Sure, we can do that."

Price tag

The Hunt 25 CC starts at \$123,500 with the Volvo 375-hp gas sterndrive. Both the inboard and sterndrive diesels are roughly \$25,000 options, while the Yanmar/Ultrajet setup is an extra \$55,330. In addition to a wide choice of power, options include a T-top, aft stern seat, windlass, teak trim, electric head, bow thruster and full electronics. ■

Hunt 25 CC

LOA: 25 feet BEAM: 9 feet DRAFT: 18 inches (waterjet), 34 inches (sterndrive), 36 inches (inboard) FUEL: 100 gallons
www.hunt-yachts.com



All in all, it was a fun couple of days on the water for Sorensen.

A boatbuilding startup is always a risky undertaking, but Hunt Yachts had a few aces in its back pocket. First was the name. Perhaps no one has done more to transform the boating world than the late C. Raymond Hunt. If you own a boat with a vee bottom, you can thank him for the great ride. (Not that all of today's deep-vees deliver a great or even a good ride, but that's another story.) The other, of course, was its hull design.

Construction

During my visit to Rhode Island, I got a

mounting bolts used in sterndrive and waterjet applications.

The hull-to-deck joint is bonded with 3M's 5200 death-grip adhesive and fastened with stainless screws. The builder uses so much 5200 that they lay down a 3-foot-wide strip of paper on the shop floor to catch the excess. This is good for the boat owner, as the fiberglass will shred before the adhesive lets go, and forget about leaks. The builder also uses blind-bolted hardware, including rail stanchions and cleats, to prevent leaks from these common drip

ZURN from Page 46

bulkhead and independent watertight bilges. At press time, the yacht was nearing completion at Lyman-Morse's yard in Thomaston, Maine. This is the first complete build undertaken by the pairing of Zurn Yacht Design and Lyman-Morse, Zurn says. While the 62 was built using limited-production tooling, he says more could be built. ■

SWIFT HITCH from Page 46

consistent and more than capable of providing a clear and focused view.

Although the literature advises against using the system within steel structures because of signal loss, I mounted the camera inside my steel horse trailer and enjoyed watching our horse munch on hay and look out the window for several hours on a road trip. (I always wondered what they did back there.) This system could easily be adapted to monitor a machinery space on board, or it could be mounted on the rear of a trailer or boat to serve as a camera for backing up when trailering. With a few electrical adaptors from Radio Shack, it's possible to power both units from the vehicle batteries, which would extend run time.

Although I don't advise doing this, I took a 20-mile trip with the camera attached to the tailgate of my truck, and it didn't fall off. (I did attach a safety lanyard.) The only concern I have with the camera mount is the potential for it to scratch the vehicle, although I used it extensively without issue. It may be helpful to place a thin piece of tape across the mounting surface to cushion the installation a bit.

Swift Hitch comes with the wireless camera and its weatherproof cover, wireless receiver, batteries, charging cord, carrying bags for receiver and camera, and instructions. Retail price is \$309. It's a product of Two Loons Trading Company and is available through PLM Trading Company at (888) 809-5183 or (603) 319-4909. Visit www.swiftbitch.com for information or to order online. ■

Q&A from Page 46

the relay contacts in the solenoid are impaired, the starter will perform poorly because this impairs the flow of electricity to the starter. Arcing over time will cause impairment. Arcing occurs as part of normal wear and eventually burns the contacts and deposits carbon on the contact surfaces. You won't see it because it occurs within the solenoid — a good reason to keep a spare. If the solenoid has been "hanging up," or not operating freely, there is more likely to be arcing and burning of contacts. This can be caused by such problems as grease or rust in the cylinder or damage to the coils inside the solenoid. ■