

# 331 WAYS TO WASTE AN LS1

PART 2

***Our DSS Competition Engines SuperPro Bullet finds its new home and gets tweaked by the master of mass airflow meters, Jim LaRocca.***

BY STEVE BAUR

PHOTOGRAPHY BY THE AUTHOR AND CRAZY HORSE RACING

In the last six months, our Midnight Blue Metallic Mustang project car has logged a mere 145 miles. Winter and travel have prevented further accrue-ment, so there is some anticipation of getting the pony up and running. It's been too long since we last rumbled down the road, offering 3,500 rpm worth of Team Bassani to the nearest contender.

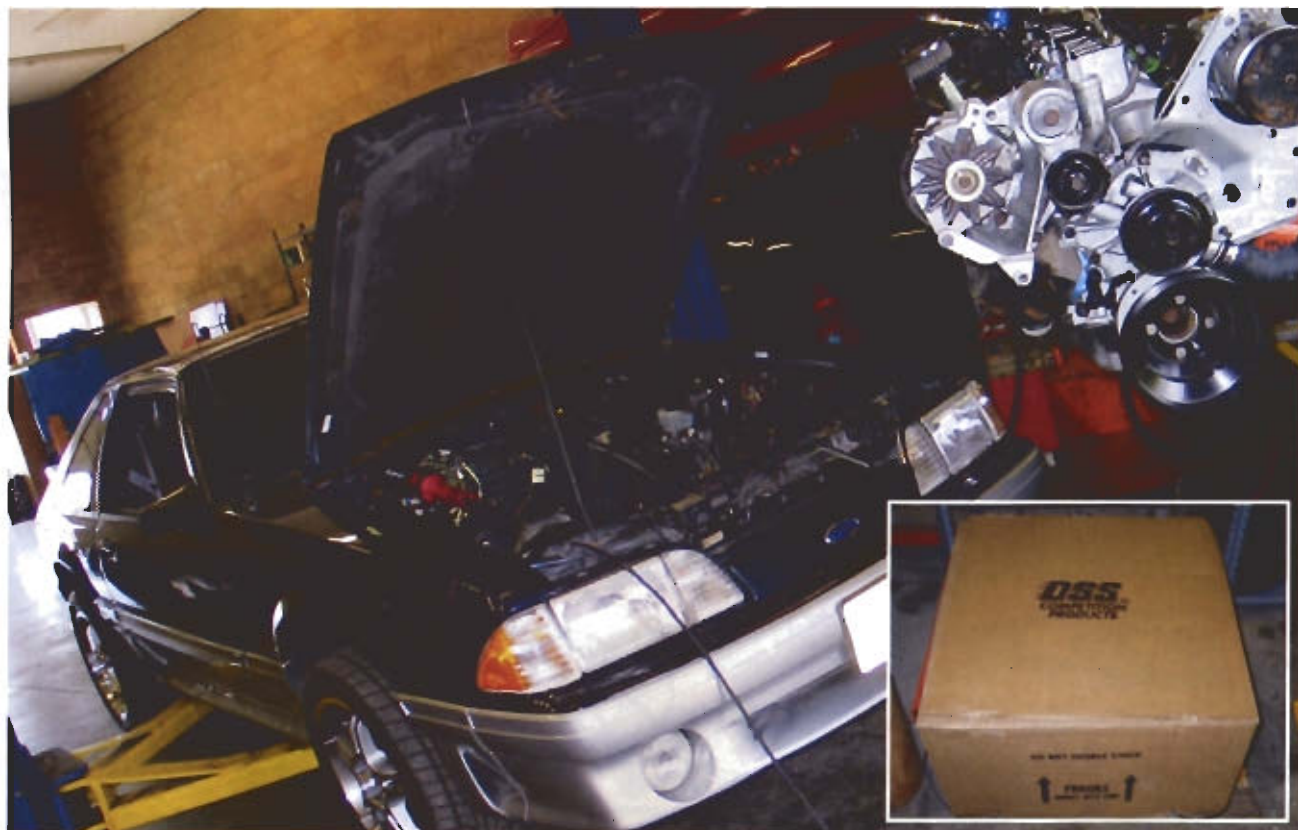
That's all about to change as we've successfully swapped in our DSS Competition Engines 331ci stroker short-block with help from Crazy Horse Racing in South Amboy, New Jersey.

Why did we pick a 331-inch motor over many of the other popular stroker kits you may ask? We posed the same question to Tom Naegele of DSS and here's what he had to say:

"Our 331 offers the best combination of rod ratio, piston design and ring package for the given 8.2-inch deck height engine. Some people don't consider the frictional losses, poor ring seal and compromised piston design that the larger strokers create. You can fix the problems associated with bigger strokers by using a taller 8.7-inch deck FRP block, but that incurs more cost. A 331 is almost 40 hp better at 6,000 rpm than a 347.

With the 331, we use a 5.315-inch rod, which allows for better ring placement on the piston and proper space between the top and second ring.

"The 347 is good for heavier cars where extra low-end torque is needed. Early on, many builders were using (and some still use) the wrong piston ring packages. This gave this combination a bad reputation for consuming oil. In some extreme cases, the poor rod ratio can even collapse cylinder walls as it side loads the piston in the cylinder really hard. But a 347 is good for 15-20 ft-lb more torque at 3,000 rpm.





*Glenn Kneil and Robert Eppie of Crazy Horse Racing set our new DSS SuperPro Bullet on the engine stand so we can begin assembly.*



*Before we start bolting on the ports though, the old motor has to come out. It has served us well for its 143,000 miles and was good for 473 rwhp.*



*Glenn disassembles the 5.0-liter, as we will be reusing many of the existing parts including the cylinder heads, intake manifold and timing chain.*



*Despite the mileage, oil of the cylinders still bore the original cross-hatch marks.*



*The oil pressure sending unit must be reused, and we'll also be using the stock oil pump pickup. You'll also need a new pilot bearing/bushing.*



*DSS includes a new cam plate, as well as dowel pins for the cylinder heads.*

"The 327ci stroker is a 331 with a standard bore. It's not a good choice for big-valve cylinder heads due to valve shrouding. The .830-inch overbore of the 331 unshrouds the valves and the machined block offers torque

plate honing that a stock block wouldn't normally have. Both of these attributes are worth up to 40 hp. It's really a non-engine builder's combo as anyone with a toolbox can put one together. But you leave a lot of

power on the table.

"The 318/320 was an economical combination we used to build before when modern strokers were still very expensive, but they're kind of obsolete now. When you





Here you can see the DSS reverse dome low-compression piston. We opted for the O-ringed block to make sure we keep the cylinder pressure where it needs to be.



Note how the DSS main support girdle is cleared for the connecting rods. All bolts are triple checked to ensure your motor is ready to go when you receive it.



For our camshaft, we chose a Comp Cams XE274HR grind. This exact cam (PN 35-518-8, \$234.95) was used with our Brodix heads in our "Ultimate Guide to Cylinder Heads" (MM&F November 2003) and produced 434 hp in a naturally aspirated 331-inch engine.

get into the 355, bigger is not always better. Rod ratio, piston design and ring seal are traded for extra cubic inches. Some builders don't think about what they are giving up to obtain those cubic inches—usually around 40 to 50 hp and some reliability. This kit is not very popular anymore."

With that said, the 331-cubic-inch stroker package made sense to us since we would be using a stock-block. DSS has made great strides in getting the factory iron to survive under three times the stock power output, but it has its limit like anything else.

Tom Naegele and Jimmy LaRocca of LaRocca's Performance (Old Bridge Township, New Jersey) both agreed that 520 rwhp (600 flywheel) is about the limit if you want the engine to last. Our 331 is certainly capable of making much more power simply



We had only logged 140-some miles on the Comp Cams double roller timing chain that we installed when we swapped the Brodix heads on, so we reused it.



We also reused our ARP head studs. For head gaskets, we chose the factory graphite pieces. According to Tom Naegele at DSS, they've seen great power had with graphite or Cometic gaskets. Obviously the SuperPro Bullet's straight deck and O-rings help keep everything in its place.



The Brodix M2 ST5.0R heads were installed and torqued to 80 ft-lb. We let them sit for 30 minutes and then backed them off and retorqued them to 85 ft-lb. to make sure there was no more stretch.

by turning up the boost or changing the cam and intake manifold to a more supercharged-specific application. However, we intend to keep our pony completely streetable and have no intention (at this time) of installing a rollbar, so we don't see the need to push the envelope. And 500 lb-ft of torque is a lot of power to put down to the asphalt and a task not easily accomplished. With a clear vision of what we wanted to do, we set about swapping in the new engine.

We were still using the stock camshaft in



Considering the mileage, the stock roller lifters had served their duty well, and despite not showing any real signs of wear, the factory pieces were traded in for a fresh set from Comp Cams (PN 851-16). The lifter cage was cleaned and bolted to the new engine.



We ordered a new stock oil pump as it offers plenty of petroleum for our pony's powerplant. The stock pickup was cleaned and reused.



Pickup to pan clearance needs to be checked to ensure that there is 3/8-7/16-inch gap. Modeling clay and a micrometer are useful in this operation.

the old engine because of piston-to-valve clearance, but with the DSS pistons we were able to sling in a performance bumpstick. We chose the Comp Cams XE274HR hydraulic roller, which features an advertised duration of 274 degrees intake, 282 degrees exhaust, and duration at .050 is 224 degrees intake, 232 degrees exhaust. Gross valve lift is .555-inch intake/.565-inch exhaust and the lobe separation is 112 degrees.

It's designed for an rpm range of 2,200-8,200 rpm and it is the same cam that Richard Holdemer used in his "Ultimate





We employed this high-performance chrome-moly ARP oil pump shaft (PN ARP1547904) instead of the stocker. Some prefer to use a stock shaft as it twists when the oil pump seizes, saving the cam gear. We'd rather beef everything up just to be safe.



We called up Holcomb Motorsports in Lumberton, North Carolina, for a new harmonic balancer. This Engine Works unit by Romac (PN NIC208SA) is SFI-approved, fully degreed and good to 8,000 rpm. It features a 28-ounce balance to work with our DSS crankshaft and retails for \$299.95.



Oil leaks suck. Plain and simple, so we splurged for this one-piece oil pan seal from the auto parts store.

Guide to Cylinder Heads" article (November 2003). His combination was a 10.25:1 compression 331 and our Brodix ST 5.0R heads came directly from the engine dyno test. With a carburetor, the combination made 434 hp and 437 lb-ft of torque.

It's not necessarily the best blower camshaft, but we went with Holdener's theory that the best supercharged engines are maximized in naturally aspirated form. This allows you to use less boost to attain the same or better performance. Plus Richard has run the same camshaft in his street car for quite a bit of time and was happy with its drivability and performance. That meant a lot to us since ours is primarily a street car.

When you get to this power level, you'll find that there are a lot of ancillary items that need to be replaced with better pieces. Even



DSS recommends using this '90-earlier oil pan with the flat middle. Some later pans feature an angle in the middle that may contact the main support system and is bad for windage because of its proximity to the crankshaft.



We reused our Comp Cams Magnum 1.6:1 roller rockers.



The intake manifold was bolted up and then it was time to change the injectors.

at stock power levels, the factory engine mounts are easily taxed and if your ride is a high-miler like ours, chances are they're completely shot. We called up Holcomb Motorsports in Lumberton, North Carolina, to get a set of Energy Suspension polyurethane mounts. We wanted them to be strong, but we didn't want to resort to a solid mount.

Holcomb also provided us with a new harmonic balancer/dampener. The Engine Works piece is made by Romac and is SFI approved. Our stock balancer was still holding together, but with the considerable investment in the short-block, we didn't want to skimp here.

Another item that we decided to upgrade was the bellhousing. Holcomb shipped us a Lakewood blowproof steel housing that is also SFI approved. It's a little overkill for our "street car," but you can't powershift without your ankles.

Of course, gaskets, a new oil pump, paint



Since we didn't really want to install an aftermarket fuel system like the one from Aeromotive, LaRocca's performance recommended stepping up from 42 lb-hr to 50 lb-hr injectors, so we called up MSD for a set of eight squirters. These competition units (PN MSD-2013) retail for \$82.99 each.



Engine mounts are a common problem with 5.0-liters and regularly fail from the torque of stock engines, let alone supercharged ones.

for detailing the engine, oil and filter and coolant are all necessary to complete the build. Crazy Horse Racing in South Amboy, New Jersey, handled the engine assembly and installation and had the Mustang up and running in no time.

While Crazy Horse is fully capable of tuning our pony, LaRocca's Performance has been tuning our ProCharged pony since day one, and therefore we already had baseline horsepower and torque numbers from the Dynojet there. That being the case, we headed back to have LaRocca check the tuneup prior to making some dyno pulls.

LaRocca recommended that we step up in injector size from 42 lb-hr to 50 lb-hr. MSD provided us with a set of its competition 50 lb-hr injectors that we complemented with a 3.5-inch Pro-M Univer mass-air meter. The Univer was designed with the ProCharger's blow-through nature in mind and can be calibrated to your particular injector size when ordered. The computer, mass-air meter and injectors all work in concert to provide the engine with the appropriate amounts of air and fuel, so it is essential that they all know each other.

With the new injectors and meter, we found that the computer had a hard time opening the injectors properly to provide the desired idle. Whereas the '94-up tuning software allows us to adjust the injector's minimum pulse width, the '93-earlier software does not offer that option. To remedy this, we

reinstalled the 42 lb-hr injectors and compensated with added fuel pressure (50 psi instead of 43 psi).

LaRocca was indeed right about us needing bigger injectors as the 42s begin to max out around 6,000 rpm. The steady 11:1 air/fuel ratio begins to head north towards 12:1 by that time, but it is still in the safe zone.

With the air/fuel ratio to his liking, LaRocca began tuning for power. At 10 psi of boost, our previous peak dyno figures came in at 473 hp at 5,500 rpm and 474 lb-ft of torque at 4,700rpm. This was with 4

degrees of timing retard and the same 11:1 air/fuel ratio. With zero retard and the same boost, the Mustang laid down 512 hp at 5,800 rpm and 500 lb-ft of torque at 4,700 rpm. In a 3,100-pound car with a good suspension, that's 9-second power folks.

As we mentioned before, this combination is easily capable making another 80-100 hp with a little more boost and maybe a different camshaft. But, we're fairly certain we've got enough to take care of those LS1 Corvettes, Camaros and Firebirds, not to mention most everything else on the road. We even



Holcomb Motorsports sent us these Energy Suspension urethane motor mounts (PN ES41122R, \$139.95) to make sure our powerplant stays put.



Something else we thought we should upgrade was the bellhousing. Knowing that our pony has some clutch drops in its near future, we heaved the stock aluminum bell housing in favor of this SFI-approved racing piece from Lakewood. Retail price for this steel scattershield (PN LKW 15203) is \$339.90. We're fairly sure our Clutchmasters aluminum flywheel will hold together, but it certainly won't hurt to have one.



Long-tube headers generally have a clearance problem with the bellhousing, which is one reason why most race headers are fabricated. Cutting the bell housing technically negates its SFI rating, but we're more worried about our ankles, not the regulations. Glenn used a plasma cutter to notch out the metal on the passenger side and then ground down the rough edges for a finished look.



Here come the cubes and LS1-smashing muscle!

# We Put The 'Perform' In Performance

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The MegaShifter is one of B&M's all-time classic shifter designs. B&M has sold more MegaShifters alone than some others have sold in their entire line. The MegaShifter is one of our most popular shifters due to its timeless good looks and high performance ratchet action. The universal floor mount feature allows you to customize it to your needs and like all B&M automatic shifters, it's cable operated for quick installation and accurate shifts!



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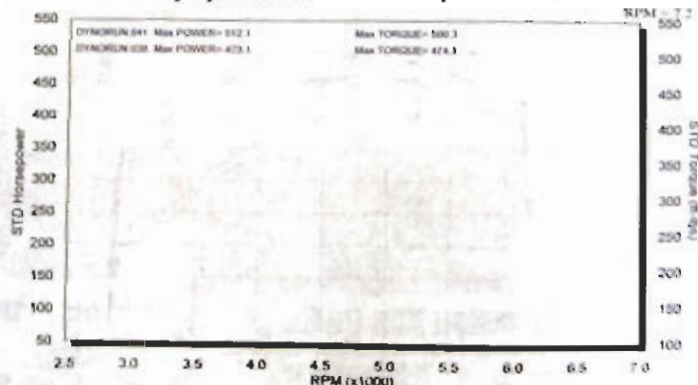


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Dynodjet Research LaRocca's performance

With our boost pressure (10 psi) and air/fuel ratio (11:1) staying the same as before, we picked up 40 hp and 24 lb-ft of torque at the rear wheels. The conservative tune (22 degrees total timing) will keep our engine making loads of LS1-killing power for years to come.



When you change the fuel injector from one size to another, the mass-air meter must be recalibrated as well. We took the opportunity to upgrade from our Pro-M 75mm Bullet to this Pro-M Univer meter. The advanced element placement is designed to read more accurately in blow-through applications like our ProCharger setup.

came across a Maserati on the way home. He thought he was a contender, but half throttle in second gear was enough to put a few car lengths between us in a matter of seconds. LS1s? Forget about it. Let's find some turbo 911s. ■■■

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(photo of prototype casting mold shown)

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