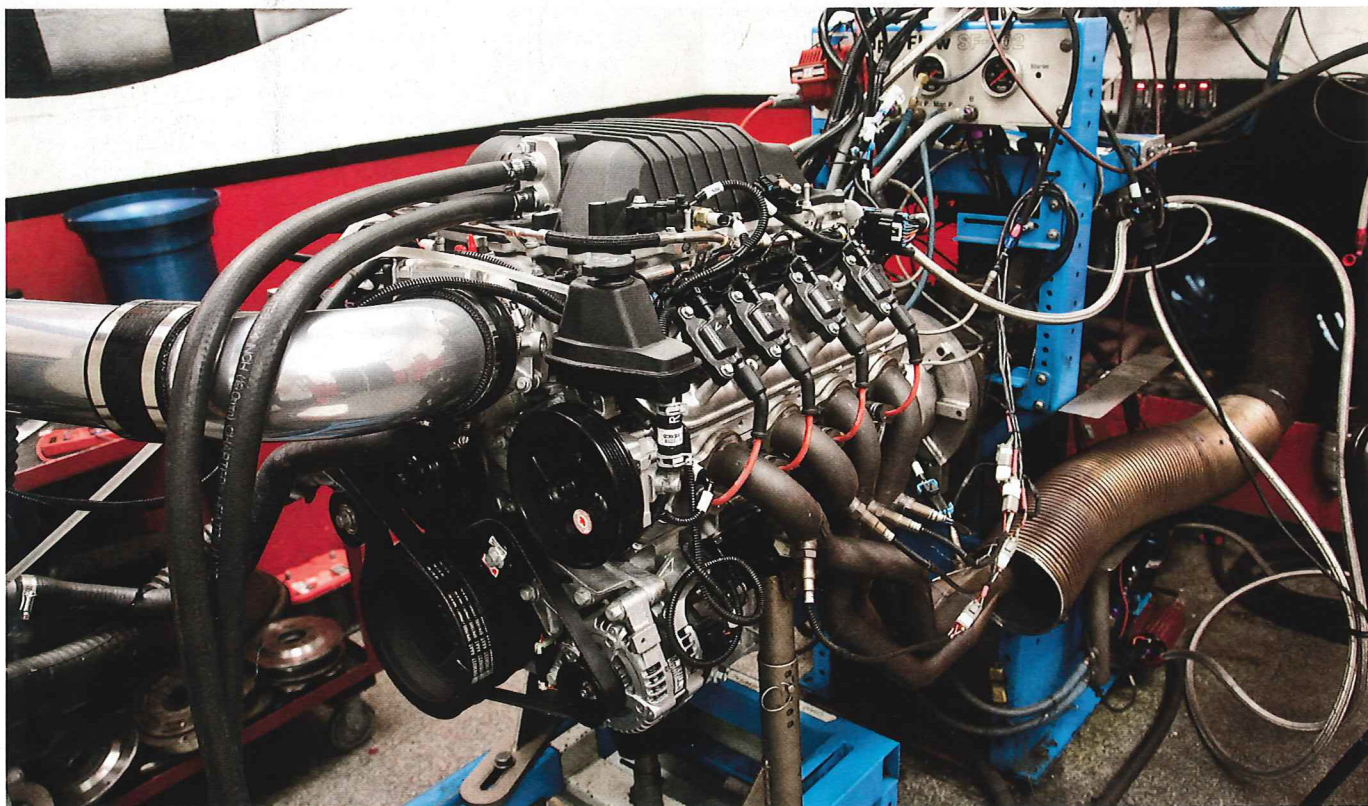


GOT PSI?

HOW MUCH HORSEPOWER CAN YOU SQUEEZE OUT OF A SUPERCHARGED LSA WITH SIMPLE BOLT-ONS? WE FIND OUT.

BY **STEPHEN KIM** | PHOTOGRAPHY BY **THE AUTHOR**



01 In stock trim at 6 psi of boost, the Chevrolet Performance LSA small-block (PN 19331507) posted baseline numbers of 569 hp at 6,000 rpm and 573 lb-ft of torque at 4,100 rpm. Since the dyno pulls did not start until after the torque curve began sloping downward, peak torque is likely higher. As a point of reference, the factory LSA camshaft produces peak torque at 3,800 rpm.

Like rhinos and mountain gorillas, Rat motors are both massive and massively powerful. Unfortunately, the similarities don't end there. Like rhinos and mountain gorillas, Rat motors also top the endangered species list. Sometimes, the demands of evolution simply favor a smaller, more efficient beast. This is particularly important in all-around performance machines like Corvettes. While Chevilles and Camaros are only expected to perform in a straight line, world-class handling is firmly entrenched in the Corvette's genetic coding.

Granted that street terrors like the legendary 427ci L71 and thinly disguised race motors like the L88 fly high in folklore, but the truth remains that the most powerful engines GM has ever built—the 650hp LT4, 638hp LS9, and 556hp LSA—are all supercharged small-blocks. Packing this much heat into a compact, lightweight, all-aluminum package makes these factory supercharged lumps perfect for restomods and Pro Touring machines. If shopping for one of these Chevrolet Performance crate engines based on hp numbers alone, the LT4 comes out on top. Despite posting the lowest hp total, however, the LSA offers the best value of the lot.

Sometimes, a quick glance through a spec sheet doesn't reveal the full story. With 638 hp, forged pistons, titanium rods and a 2.3L supercharger, the LS9 offers loads of hop-up potential. However, that potential comes with a stiff \$25,509 MSRP. In contrast, the 650hp LT4 is downright cheap at \$15,625, but its much smaller 1.7L supercharger limits hp potential. Direct injection, variable valve timing and Active Fuel Management make tuning the LT4 more challenging as well. Interestingly, the LSA is a swapper's dream come true despite posting the lowest hp figure.

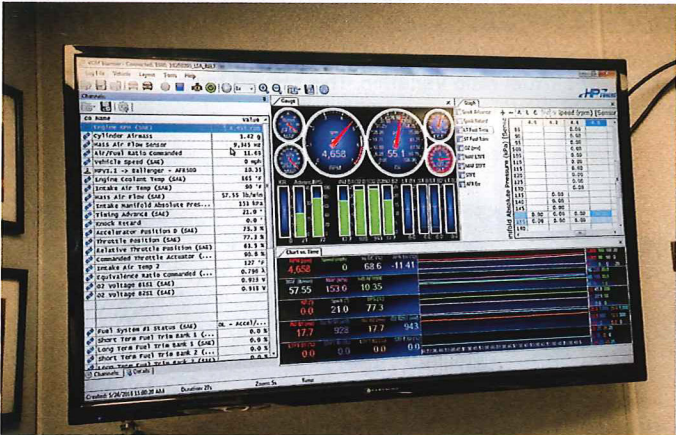


04 NGK rates the heat range of its plugs on a scale of 2-11. With a projected boost pressure of 15 psi when all is said and done, our test LSA called for a cooler #8 plug to decrease the potential for detonation.

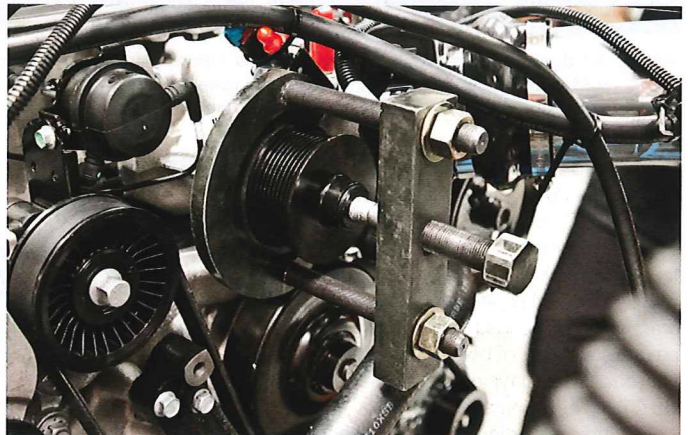


05 Since factory air-to-water intercoolers require a separate heat exchanger for the intercooler liquid, they actually function as air-to-water-to-air intercoolers. There's no practical way for a cooling fan to simulate the volume of ambi-

ent air moving through the heat exchanger at freeway speed, so SAM Tech circulated a steady stream of ice water into the intercooler core using an electric pump. Inlet air temperature was held at 80 degrees at the beginning of each pull to ensure consistency.



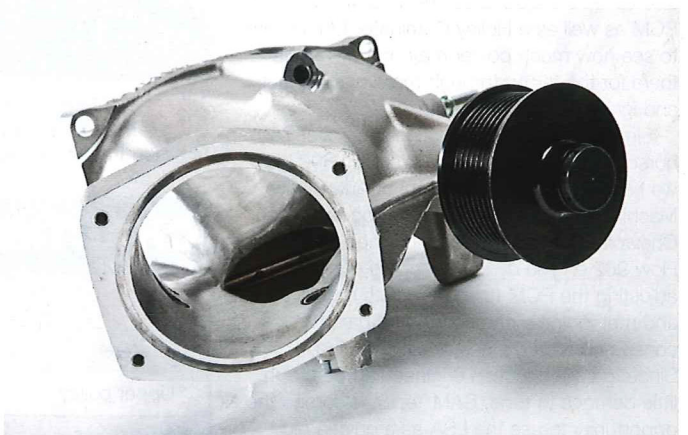
06 When matched with HP Tuners tuning software, the factory GM PCM is an incredibly capable unit. Although airflow and engine load changed dramatically throughout the course of dyno testing, SAM Tech was able to keep the air/fuel ratio steady at 11.9:1. The LSA responded best to 24-26 degrees of ignition advance on 93-octane pump gas.



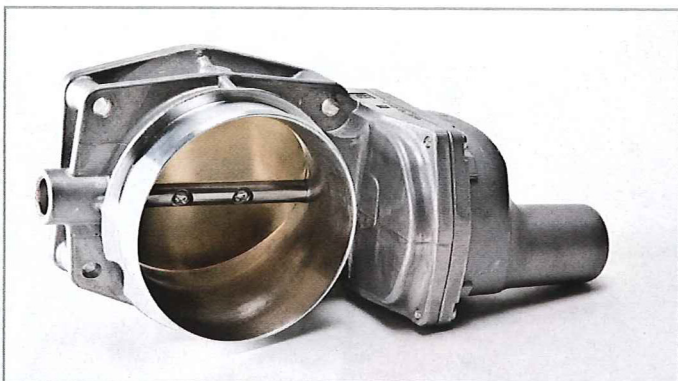
07 Unlike most superchargers, the blower shaft on the LSA is not threaded, which makes it difficult to remove the pulley using a standard puller. To make way for the Weapon-X 2 1/2-inch overdrive pulley, SAM Tech rigged up a custom puller that doesn't need to thread into the blower shaft.



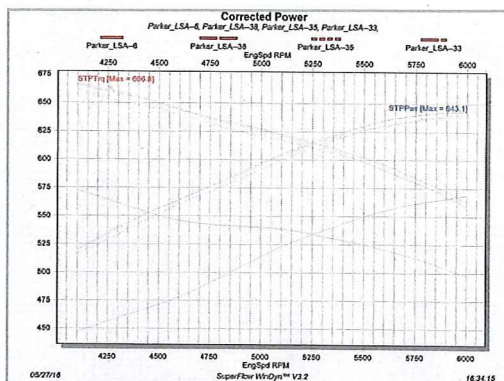
08 The Weapon-X upper pulley kit includes a steel hub that must be pressed onto the blower snout. Once installed, it allows for easy pulley swaps by sliding a new pulley onto the hub and cinching it down with retaining bolts. Once back on the dyno, the pulley boosted output to 639 hp and 661 lb-ft of torque.



09 At elevated boost pressures, the stock supercharger housing can become a restriction. Enabling air to flow more freely through the blower increases flow and decreases inlet air temperature. For \$1,650, Weapon-X offers porting service on the supercharger snout, lower intake manifold and throttle body. The company says the work is good for a 30-40 percent increase in airflow.



10 Stock LSA engines come equipped with 87mm throttle bodies, but Weapon-X offers a choice of ported 87-, 90- and 102mm upgrades. The blower snout inlet was opened up to match the throttle body as well. We opted for the 90mm unit.



11 Although swapping pulleys provides the biggest jump in hp, every little bit of extra airflow still counts, even on a supercharged engine. The ported blower snout netted a one-horse-

power gain in peak power, but more importantly, a five hp gain throughout the midrange. In contrast, the ported throttle body picked up one hp in the midrange, but three hp at 6,000 rpm, bringing total output to 643 hp and 667 lb-ft of torque.



12 Forced induction makes most hot rodders greedy, and the need for more boost was met with a set of ATI overdrive crank pulleys. We tested both 5- and 10-percent overdrive pulleys (PN 916105 and 916106). The slick setup also includes a new hub (PN 916032-M3), a Super Damper (PN 918854) and an A/C pulley (PN 916734).



13 Once horsepower hits the 660 mark, the stock 56-lb/hr fuel injectors become marginal. We replaced them with a set of DeatschWerks 1,500cc injectors (PN 16M-22-1500-8), which will provide more than enough fuel to support 800-plus horsepower.



14 Accessing the front retaining tab for the fuel rail on the crate LSA requires removing the supercharger lid, which also houses the intercooler. After detaching the rail, the new injectors are a direct replacement for the stock units.



15 After removing the factory balancer and installing the new A/C pulley, the ATI hub was installed onto the crank. The Super Damper attaches to the hub. SAM Tech used a piece of angle iron bolted to the hub to prevent the crank from turning over while torquing down the balancer.



16 The ATI overdrive pulley attaches to the damper with three bolts. The 5-percent pulley bumped output to 682 hp and 705 lb-ft of torque, while the 10-percent pulley increased output to 725 hp and 736 lb-ft. That's a solid 156hp increase over our baseline numbers. Not too shabby for a bunch of bolt-ons. Next on the agenda is a cam swap, intake manifold porting and a stock PCM vs. Holley EFI shootout. Stay tuned.

Sources

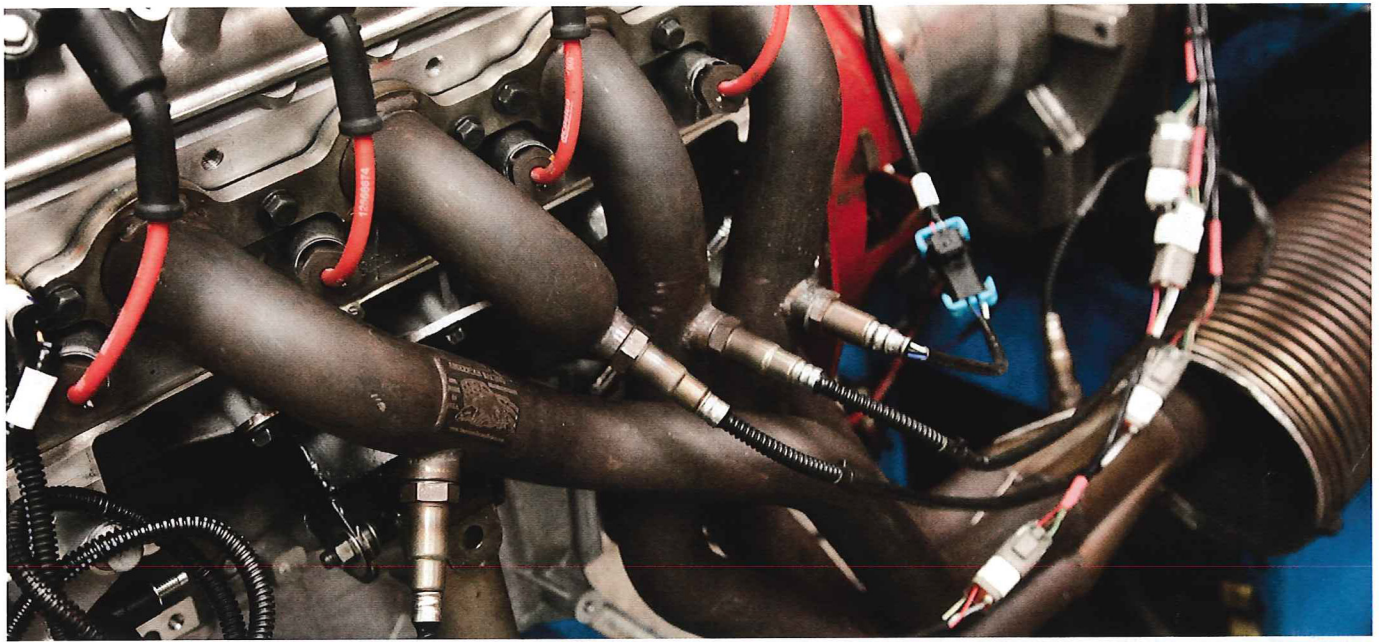
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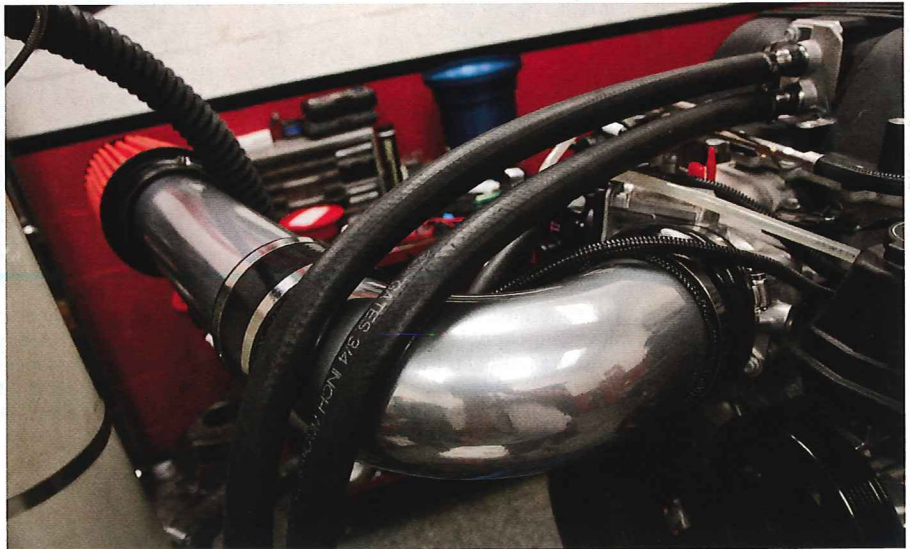


02 All dyno runs were performed using a set of 2-inch American Racing long-tube headers. SAM Tech fitted each primary with a wideband oxygen sensor to keep a close watch on cylinder-to-cylinder air/fuel ratio variation. This proved to be very useful as distribution inefficiencies in the stock intake manifold became more prevalent at elevated boost pressures.

Strapped with a 1.9L blower, the LSA offers more power potential than the LT4 while boasting a lower price tag. While 556 hp for \$14,006 is already a whole lot of bang for the buck, we wanted to see how much more power we could squeeze out of a stock LSA crate engine. The idea was to replicate the natural sequence of bolt-on modifications a hot rodder would typically perform on a Cadillac CTS-V or a Camaro ZL1.

That meant starting outside the engine with low-hanging fruit like a cold-air induction system, headers, overdrive pulleys and a ported throttle body before digging deeper into the engine by swapping cams and porting the supercharger snout and lower intake manifold. To make things a bit more interesting, we also tuned the electronics using both the stock PCM as well as a Holley Dominator EFI system to see how much power may or may not be there for the taking through more precise fuel and ignition control.

Similar combinations routinely net over 750 horsepower. With visions of cracking 800 hp, we headed over to the School of Automotive Machinists and Technology, and loaded up our Chevrolet Performance LSA on their Super-Flow 902 engine dyno. Swapping out parts, adjusting the PCM tuning for each modification and methodically charting the hp gains consumed a solid week of dyno testing. Since forced-induction engines can be tough little demons to tune, SAM Tech welcomed the opportunity to use the LSA as a guinea pig for its EFI Tuning course, teaching students how to tune for driveability and longevity as well as maximum power output. It's way too much information to cover in a single story so we're going to split it up into multiple installments. **VETTE**



03 To simplify LS swaps, Chevrolet Performance offers a universal 3 1/2-inch cold-air induction system (PN 19301246) that utilizes a conical, high-flow air filter. The tubing also includes a mounting provision for a factory mass airflow sensor.

CHARTING THE GAINS

	HP	TQ
Baseline	569	573
Upper pulley	639	661
Ported snout	640	662
Ported Throttle Body	643	667
5% crank pulley	682	705
10% crank pulley	725	736