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# GM High-Tech PERFORMANCE

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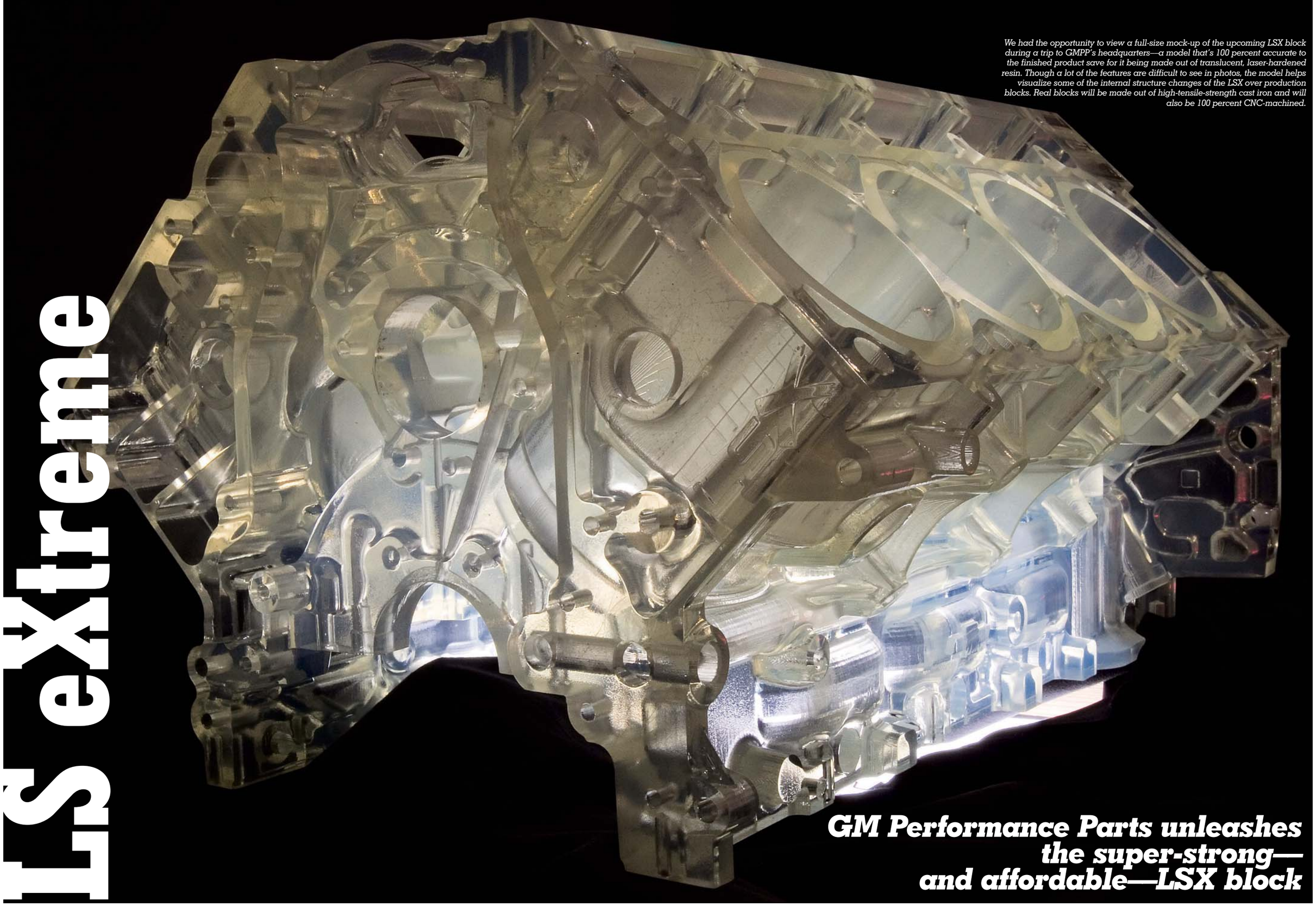
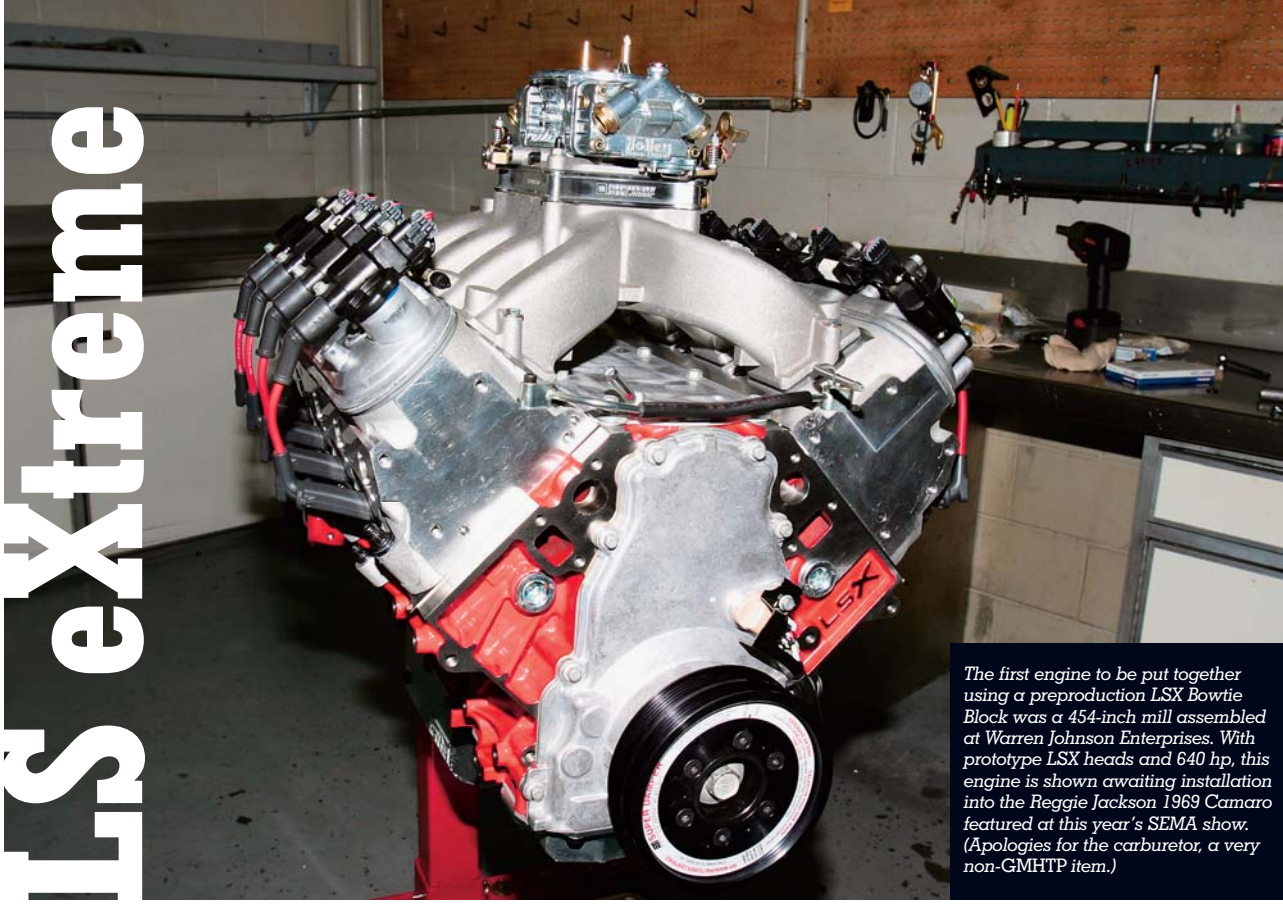
# LS extreme



*We had the opportunity to view a full-size mock-up of the upcoming LSX block during a trip to GMPP's headquarters—a model that's 100 percent accurate to the finished product save for it being made out of translucent, laser-hardened resin. Though a lot of the features are difficult to see in photos, the model helps visualize some of the internal structure changes of the LSX over production blocks. Real blocks will be made out of high-tensile-strength cast iron and will also be 100 percent CNC-machined.*

***GM Performance Parts unleashes the super-strong—and affordable—LSX block***

# LS extreme



*The first engine to be put together using a preproduction LSX Bowtie Block was a 454-inch mill assembled at Warren Johnson Enterprises. With prototype LSX heads and 640 hp, this engine is shown awaiting installation into the Reggie Jackson 1969 Camaro featured at this year's SEMA show. (Apologies for the carburetor, a very non-GMHTP item.)*

**BY CHRIS WERNER**
**PHOTOGRAPHY BY RICK JENSEN AND COURTESY OF GENERAL MOTORS**

Every GM aficionado knows that factory engine blocks have practical limits, both in terms of durability as well as displacement. Although production LS1 and related Gen III and IV family engine blocks have enjoyed a relative excellent track record since their 1997 model year debut, cubic inches and longevity have come into question for more extreme horsepower applications. Until recently, the only solution to this dilemma was to plunk down about six thousand dollars for a C5R block; and while this option has certainly been viable for a corporate-sponsored race team, it has not normally been financially feasible for the average big-boost street/strip Z28. The fact of the matter is, as more and more enthusiasts encounter the limits of factory aluminum and iron blocks, the collective desire for an affordable, high-strength, big-inch casting has grown tremendously.

This need hasn't gone unnoticed by the aftermarket. With practices like block resleeving becoming more common, it's clear that consumers want more cubes; and perhaps more tellingly, high-strength aftermarket engine blocks have started to trickle onto the market (see "World at War," March 2006). Simply put, GM has stood on the brink of losing potential customers who feel the need for serious speed—particularly those who don't operate on race team bankroll.

Rest easy, power mongers: this spring, GM Performance Parts will release its revolutionary LSX Bowtie Block, a versatile, extreme-duty foundation that will also be surprisingly—if not downright shockingly—affordable.

"The goal with the LSX is to have a very feature-rich, high-end, race-capable LS family engine block," says Dr. Jamie Meyer, Product Integration Manager for GMPP. "But we also wanted to make sure that this block was within the grasp of just about any budget." You'll be pleased to hear the LSX Bowtie Block's projected MSRP will be around $2,500, with actual street prices likely in the neighborhood of $1,800 to $1,900. Compared to any other high-end block on the market—GM or otherwise—that's virtual pocket change. And what's truly astounding is the kind of value that comes along with this investment.

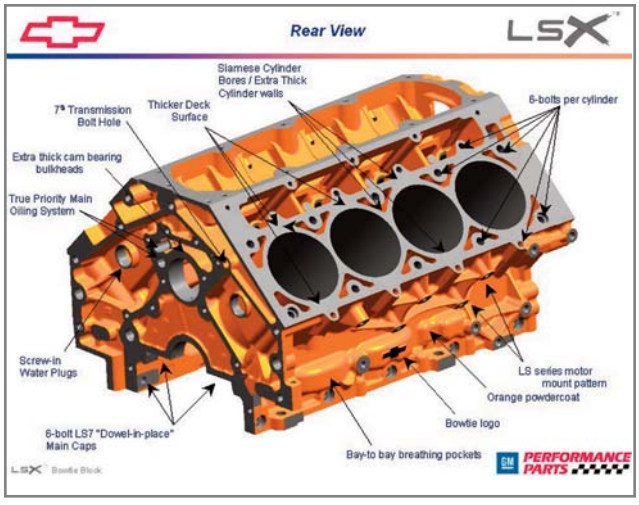
"We wanted a block that customers could really grow with," continues Meyer. "It's for this reason that we wanted as much rebuildability and compatibility as possible, and the LSX Bowtie Block offers across-the-board parts interchangeability. Thanks to this, a customer can build and rebuild an engine as his or her budget may allow—all without having to ever buy another block. With the strength we have built into the LSX, it has the structural character needed to withstand many years of use and abuse."

Read on to get some insight into how this project came about at GM, as well as what makes this new Bowtie Block so special from a technical standpoint.

## BEHIND THE SCENES AT GMPP

We spoke at great length to GM Performance Parts' Thomas Bates, a man whose title of Marketing Specialist deceivingly undervalues his position with the company and his role in the development of the LSX Bowtie Block. Basically, he's a product development specialist whose job is literally to bring good ideas to life—and to the market. "This LSX block wasn't originally my idea, it was that of the guy who was my boss at the time," states Bates. "He came to me and said, 'You know what would be really cool? An iron 6.0L block that you can bore the snot out of!' My response was, of course, extremely positive—and the next thing we knew, we had the really stout, killer piece of equipment you see here!"

Of course, a lot of design work transpired after the conception of this Bowtie Block, and Thomas was assigned a team of engineers to make the idea a reality. Trade-offs are inevitable when marketing folks and engineers come together to discuss what is dreamt of and the truth of what is actually possible. But what is so amazing about this project is how much of the original hopes came to fruition. "What we had typically done in the past when designing a block was to borrow production block tooling and modify




*This slide provided by GMPP shows many of the outstanding features of the LSX—and they're not just race-specific. Beyond power-oriented items like six head bolts per cylinder and Siamese bores, the LSX retains all OEM exterior mounting features for all accessories and even incorporates an additional transmission bolt hole to better comply with the rules of drag racing sanctioning bodies.*


*Up top, a thicker deck surface adds to head gasket retention even when using standard 11mm bolts or studs. Beyond this, the LSX block can be machined for up to half-inch head studs and also allows for use of a six-bolt head bolt pattern for applications with truly sick cylinder pressures. Down at the bottom, LS7 billet steel main caps are included and use 10mm fasteners; but if this isn't enough, the block can be drilled for use of larger studs. Large LS7 bay-to-bay breathing windows are used for reduced parasitic pumping losses. Says GMPP's Thomas Bates, "Finite Element Analysis was performed to determine where all the stresses were in the block, and what we found was that in the area where these windows are placed, there is no stress to begin with. All of the stresses pull on the middle of the block and around the outside of the block, which is where the main caps are tied in."*

# LS eXtreme

it a little bit to get the cast we wanted. But with the LSX, there was no tooling to be had, because GM had destroyed it already," says Bates. "So we decided to make our own tooling, which is a big investment—but it just so happened that in doing so, it would enable us to make this new block all things to all people. That's pretty much how we went about designing most everything on this block: we opted to incorporate all of the features we needed from the get-go so that we didn't have to look back three years down the road and say, 'Oh jeez, that would have been nice!'"

Not the least of these features is the LSX's massive bore size. When talking about the project early on, Bates' team discussed certain parameters that they wanted to try and meet if at all possible, and one of the main ones was a 4.25 bore. "Granted, this would only be for a naturally aspirated application—but being able to accommodate this bore size would go a long way toward making competitive aftermarket blocks pale in comparison," says Bates. "It's one of the specific reasons we decided to do an iron block: to have the ability to go quite large, and—unlike with techniques like resleeving—still have a lot of strength left. That said, it was up to the engineers to figure out exactly how to accommodate this, and I'm happy to say we were able to do it."

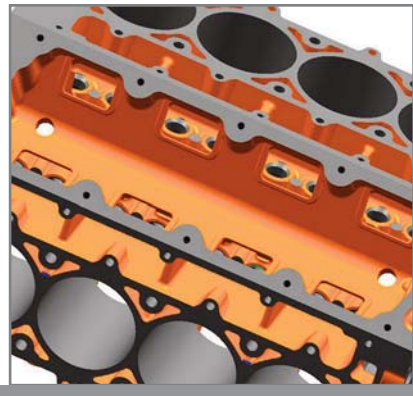
That's no misprint: 4 1/4 inches! Thanks in part to the LSX's Siamese bores, this gaping diameter still leaves a 0.200 minimum wall thickness and is a full 1/8 inch larger than anything else out there. Combine this with the recommended max crank stroke of the same value, and you've got yourself over 482 cubes. As if this weren't enough, a tall deck version of this block will be available soon after the standard deck model's release. Its 9.700-inch height (nearly 1/2 inch taller than the standard deck model) will accommodate a crank with massive 4.500-inch throws, which translates to cubic inch displacements of well over 500 ci! But feel free to build as small as you like, too, as the blocks will be shipped with a ready-to-hone 3.990 bore.

There's a lot more to the LSX than just the ample cylinder bore, of course, and lots of design challenges dotted the path the GMPP team was to follow. The balance of cost versus result was present in the mind of the team the entire way, but with a little help, the latter usually won out. Says Bates, "We had our work cut out for us, but we cooperated with the GM engineers for the production iron and aluminum engine blocks; they have literally spent thousands of hours developing and testing these blocks to ensure they're the best products for them, and we used that knowledge to our advantage. The perfect example of this is the LS7 block's bay-to-bay breathing windows that the LSX retains: there were many man-hours spent determining the size, shape, and placement of these. It would have been stupid to just say these guys don't know what they're doing and ignore it. If a lesson had been learned internal to GM, we were going to utilize it as much as possible."

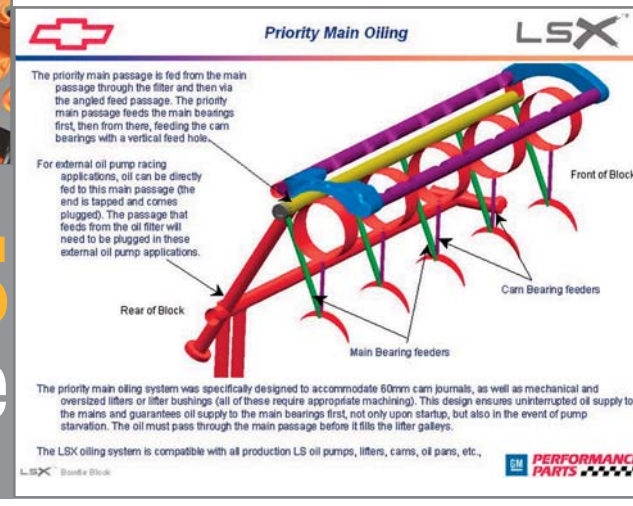
This isn't to say that the LSX lacks substantially different features from production GM blocks. But the beauty of it is how much is improved over other blocks, yet how much has stayed the same in order to retain compatibility. "I had a lot of things to work out with my engineers," admits Bates. "If I put my foot down and said things had to be a certain way from a marketing aspect, they'd look back and figure out what it was going to take to make things so. Normally, they'd be able to accommodate my needs and deliver the desired design parameters. But on certain occasions, some things that I wanted just weren't feasible—fortunately, this only happened with respect to aspects of the design that weren't necessarily critical." Thomas related the perfect example of this in his desire to accommodate both the Gen III-style cam sensor in the back of the block as well as the Gen IV-style at the front. As it turned out, the LSX block project would have taken a large setback had they chosen to incorporate both of these options, and in light of the fact that a Gen IV front cover is not that expensive, it was decided that customers wouldn't really mind having to convert to the Gen IV style if needed. "It was just another way to deal with the issue rather than add the extra time and expense into our development and manufacturing."

## A TRUE TEAM EFFORT

As if all of the talent contained within GM wasn't enough, a well-known outside friend and corporate liaison joined in to help make the LSX one of the single toughest engine blocks ever made. That man was none other than Pro Stock legend and six-time champion Warren "WJ" Johnson. Dr. Jamie



*Gen III/IV heads normally cover the lifter area completely, but a view into the LSX's lifter valley shows the access windows to the lifters. They allow nuts to be placed on the ends of downward-facing additional cylinder head studs. "I'm not going to say it's a cakewalk to get your fingers in there, but it's not that hard either," says GMPP's Thomas Bates. "An average person can do all eight in the span of about five minutes. The only downside to them is that they prevent the use of Displacement on Demand technology—but with a specialty, high-power block like this, it's doubtful customers are going to mind!"*




*True priority main oiling ensures total crankshaft protection, and production blocks don't use this type of system simply because of the convenience for machining. To accommodate such a system, two extra slots must be cut and six extra holes drilled into the block—from a production perspective, every hole not drilled is money saved. "But again, we're trying to make this block all things to all people," says Bates. "So while the average Joe does not require the extra oil for the crankshaft, hardcore guys who may potentially generate a couple thousand horsepower want to be confident that they won't be knocking bearings out. There's also the safety factor of if somebody loses a lifter, it won't starve the oil supply to the crankshaft. And, provisions are included to restrict oil flow to the lifters if you'll be using a mechanical cam."*

# LS eXtreme

Meyer enlightens us as to how this relationship blossomed. "It's a really amazing process in how Warren got involved, because while he has been sponsored by GMPP for two decades, we'd never 'activated' that sponsorship in the consumer production side of an engine component.

"We met with him at the SEMA and PRI shows last year and talked with him about some of the projects that we wanted to do. He immediately gravitated toward helping us design a high-end, LS-family engine block. WJ followed our design process closely; in fact, during the build of the very first LSX engine at his own engine shop, he was commenting on what he saw as far as the application of that block, in addition to all the math data he had been getting—things that he'd fix before it goes into full production. His insight has been very valuable to us."

One of the things that makes the LSX so tough is the sheer amount of cast iron that goes into it, causing the standard deck version to weigh in at a full 225 lbs. With the weight of your average LS1 or LS2 aluminum block being about half this—and a production iron block falling somewhere in between—a vehicle with an LSX Bowtie Block will incur somewhat of a weight penalty. But this extra mass is thanks to the GMPP team having added extra material in several critical areas, including around the cam tunnel, around all of the bores, under the deck surface, and about the head bolt holes. Mr. Bates explains why this is and how it relates to Warren Johnson. "We're trying to accommodate everyone with this block, and if it wasn't for trying to make it economical to cast in any kind of volume, then sure, there are places where meat could have been taken out. But we had to evaluate: is it better to have an extra 5 or 10 lbs, or to make the block $700 more expensive to the consumer? The good news is that those that want to lighten the block for their application can hook up with their CNC house of choice and take an extra 20, 30, or even 40 lbs out of it. And as far as WJ goes, we're looking at what potentially would be considered a Warren Johnson special edition of this block that has a whole bunch of weight knocked out of it from the get-go."

## SPEC IT UP

Hopefully you're starting to get a better idea of the sheer scope of the LSX Bowtie Block project and the magnitude of the result. We've hinted at and expounded slightly on some of the important features of this block, but with the above background information having been said, let's go through a few of the main attributes of the LSX in some detail (and be sure to check out the photo captions as well).

### STRENGTH!

The LSX is pure stoutness, but its extra material thickness is not simply a case of pure unadulterated addition of bulk. The iron itself is special, exhibiting a claimed 15 percent tensile strength increase over the cast iron used in production engine blocks (280kPa for the LSX versus about 220–240 for a standard 6.0L iron block). "Though we explored using materials up to 300kPa or so tensile strength, this would result in a casting that would be much harder to machine," says GMPP's Thomas Bates. "Unlike production blocks, each LSX sits in the CNC machine several hours to get a finished product—a harder material would take longer than this, and machining time is everything when you're talking about feasibility. What it came down to was whether a customer would really need a 300kPa tensile strength casting—and having answered this question in the negative, we opted to go with 280, which should be just about right to handle all the things people want to do with the LSX."

So, just what kind of real world strength are we talking about, then? With GM's aluminum LS7 and C5R blocks having been known to withstand quadruple-digit power numbers in certain applications, the LSX looks to better these values substantially. Explains Bates, "Cast iron is inherently stronger than aluminum, so we're expecting to see some really solid numbers before we see any type of critical failures. We truly don't know the limit of this block right now, as there is a whole lot more to it than just our mathematics and computer simulations. But I can say that when we worked out the engineering on this block, everything was done with an eye toward withstanding 2,000–2,500 hp." Although Thomas says this number would likely only be possible in an engine that ran for short periods of time (i.e. drag racing), it's still quite a number!

### POWER!

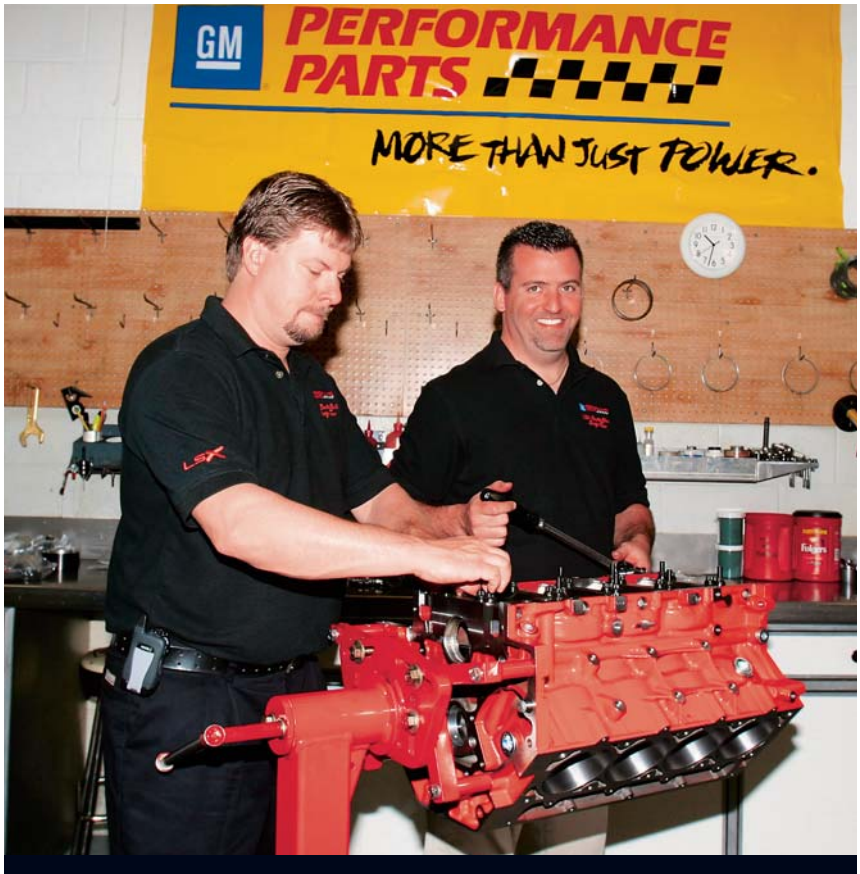
We've already discussed the LSX's massive bore and stroke potential. But beyond sheer size, other power-enhancing features abound. Large main web bay-to-bay breathing passages exist in the bottom end, and as mentioned earlier, they're a direct carryover from the LS7 aluminum casting. "The six-bolt main cap design of


*It'll be easy to spot an LSX under the hood, what with GM, LSX, and Chevrolet bowtie logos cast into the block. Note the LSX logo is now a trademark of General Motors. Ample bay-to-bay breathing pockets are also readily visible externally, and all blocks will come finished with a durable orange powdercoat. In the words of Dr. Jamie Meyer, "I think that every good brand claims a color. Orange goes way back for Chevrolet, and we've had it on our GMPP crate engines for years. It's also very clear that orange blocks are much faster than other blocks," he jokes.*

the Gen III/IV engine really closes off bays one and two from bays three and four," explains Thomas Bates. "In production prototype testing of the Gen III, engines would literally stop revving at about 5,000 rpm because the air couldn't move around enough when no windows whatever were used. The problem was addressed for production blocks, and when GM went to the LS7, engineers were looking for particular rpm ranges and power levels. What they found was that by increasing those window sizes they picked up substantial amounts of power. With the LS7, it made a difference of about 20–30 hp—and as rpm climbs, the more difference it makes."

For hardcore racers, other block features give the capacity of additional power gains, even if indirectly. One such feature involves the lifters. "Those who are going to use these blocks in extreme applications (such as WJ) will want to use a larger diameter lifter so that a more serious camshaft can be used. We decided that the extra pound or so of material it would take to give the block the ability to go to a 1-inch lifter or bushing (if desired) would be worth doing now instead of being second-guessed later," says Bates. Fear not, though: stock lifters will work just fine in this block, and unique lifter retainers are supplied to clear the six-bolt head pattern.

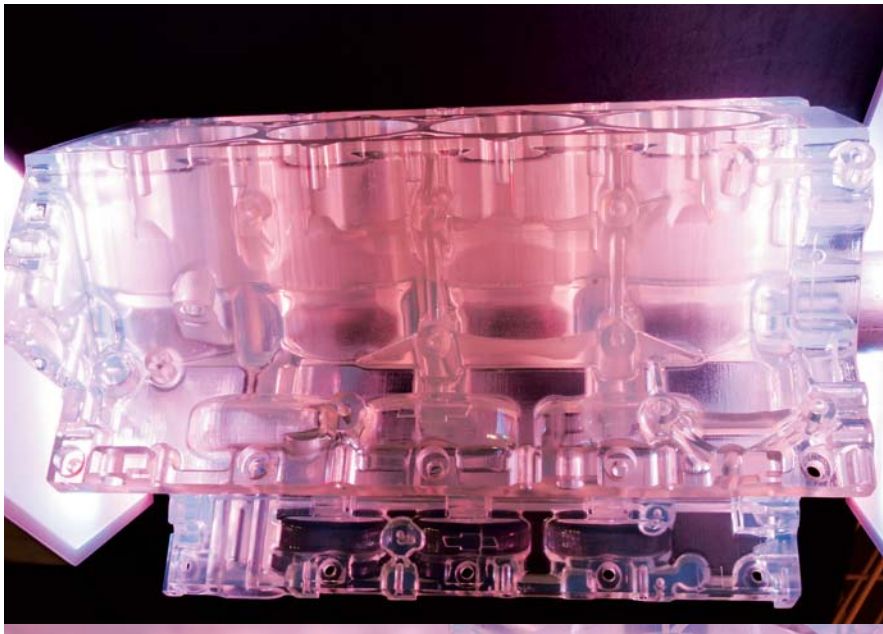
Wait, did we forget to mention that this sucker has six head bolts per cylinder? That's right! GMPP's team knew this engine block would be used in engines running extreme cylinder pressures—especially forced induction applications—and understood the need for additional clamping force over what production-style head bolt patterns can provide. Though the addition of a fifth head bolt along the outer edge of the block below each bore was relatively straightforward, what's interesting is how GMPP chose to go about placing the sixth: as it's located directly above the cylinder, this meant it had to be somewhere in the vicinity of the lifters. While a competitor's six-head-bolt block design utilizes a stud in the lifter area of the block, Bates indicates that his team's FEA computations showed possible detrimental effects on the valvetrain using this approach. The decision was made to use a somewhat unconventional solution: a stud that actually threads into the cylinder head and sticks through the block deck surface. "This extra fastener is in an area that's not necessarily the easiest location to get to, but is the optimum place for it from an engineering standpoint," says Bates. "In the valley area, we have a window for each cylinder that is about 3 inches wide and 2 inches tall so that you can get your finger in and put a nut on the stud from the bottom side. A similar approach has been used successfully on the big-block Chevrolet. Of course, these holes don't have to be used if they won't be needed on a given engine—feel free to bolt up standard Gen III or IV heads if you like," Bates states.

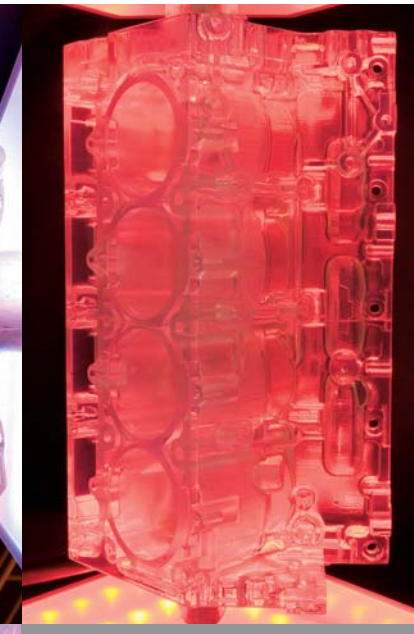


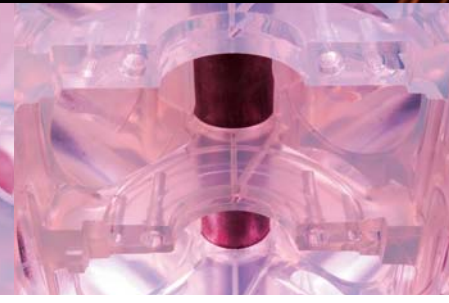

*As GMPP's Thomas Bates and Shawn Smith assemble the first LSX-based engine ever, we can't help but wonder what all the smiling is about. Oh wait, it's because they've come up with one badass engine block! Soon enough, you'll be able to assemble your very own—the question is, will you be ready for all the power?*

## VERSATILITY!

Let's face it: the toughest block in the world is totally worthless if you can't install it in your car. But thanks in part to keeping the classic small-block 4.400-inch bore spacing, all Gen III/IV parts will fit into this Bowtie Block. Heck, you could pull apart your Corvette's LS2 rotating assembly and plop it all into the LSX if you wanted to—and you could even reuse all of your stock GM fasteners as well. The LSX Bowtie Block will accept any pair of LS series cylinder heads, production type cam or crank, water pump, timing chain, oil pan, or lifters—you name it, it's all directly interchangeable! The sole items unique to the LSX engine block are the front cam retainer plate, billet aluminum rear seal cover, and lifter retainers, and these are all







# LS eXtreme

supplied with the block. (As discussed earlier, the only other caveat is that the front cover, while not supplied, just has to be a Gen IV version, thanks to the aforementioned front-mounted cam sensor provisions). In addition, any LS-style oil pan and oil pump can be used, including the LS7 dry sump system. Plus, all oiling system holes are threaded, and (in addition to the LS7 hookups) there is an external oil pump feed at the rear of the block for anyone who wants to utilize an external pump dry sump system.

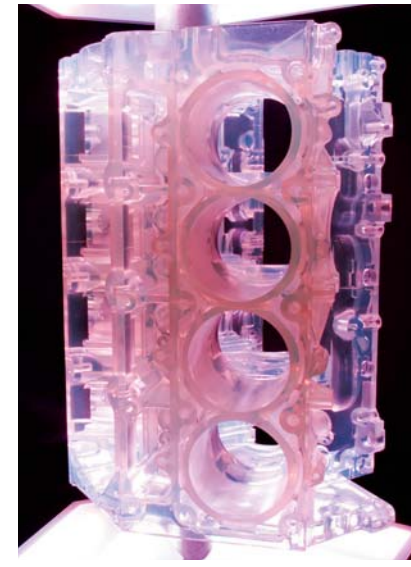
Beyond internal parts compatibility, all production accessory holes are also retained on this block. This means that all factory A/C compressors, power steering pumps, alternator brackets, and the like will bolt up. "You don't have to worry about any holes being moved around, deleted, or anything of the sort," says Bates. "In fact, in looking at the production blocks, there were some bolt holes that we weren't even positive what they were used for, because they dated back to the very first set of tooling that was done for the Gen III. But we decided to cast them in anyway just in case!"

## CONCLUSION

Hopefully, you can see that even with all of its features and its relatively affordable price (substantially less than an LS7 block, and way less than a C5R) the LSX Bowtie Block is the total package. It's a super-strong, super-dependable, big-inch block aimed at both full-on race teams and those with less-than-stratospheric budgets alike.

But perhaps the best news of all is this: the LSX is only the first glimpse of a full-on GMPP effort to supply enthusiasts with all the parts they could possibly need for serious Gen III/IV power. "It should be no surprise that we will have a full lineup of LSX components," says GMPP's Dr. Jamie Meyer. "The logical place to start was a block that everyone can afford. There are discussions now about aluminum versions of the LSX, and we've done a lot of research on camshafts and heads, so you can expect parts on that end of the spectrum. And then, obviously, GMPP's main business is crate engines … so using the immediate success we have had with the SEMA-debut Reggie Jackson engine, I think it's safe to say that you'll see several LSX crate motors offered in only a matter of months."

There you have it: GM is finally sinking its teeth into a Gen III/IV scene that has heretofore been completely dominated by aftermarket companies. To say that this is an exciting time to be a GM enthusiast would be the understatement of the decade. ■



## SOURCE

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