Ruthless Pursuit of Power: *The Sequel*

’02 LS6: More Power. More Torque.

by Hib Halverson

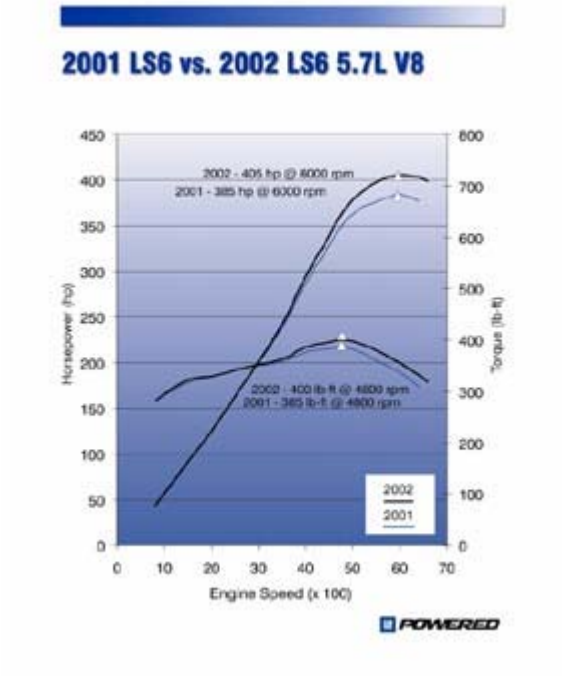
On the outside, an ’02 LS6 is pretty hard to distinguish from an ’01. In fact, other than the engine number stamped on block, most people will not be able to tell the engines apart. Image: GM Powertrain Division.
[Click Image for Larer View]

For 2002, "more performance" is part of the mission statement of the Corvette folks at GM’s Powertrain Division. That was made obvious to the staff of *The Idaho Corvette Page* in a media briefing at Irwindale Speedway in California on May 10, 2001 when "Doctor" John Juriga, Assistant Chief Engineer for Gen III Passenger Car Engines announced: LS6 for ’02 will generate 405 horsepower and 400 pound/feet torque,
20 more hp. and 15 more lb/ft. over the ’01.

Can you feel the difference?

Heck yeah–but only if you’re driving a Z06 as it’s supposed to be driven: real hard. The LS6’s extra power is all up top and it makes the ’02 Z06 the quickest production Corvette ever. Some intel we’ve developed about GM’s in-house, ’02 Z06 testing suggests an astonishing, 3.85-sec. 0-60 and quarter mile performance at 12.45/118.0 mph. That’s using timing with no roll-out (rather than drag strip clocks), on a typical road surface and at the hands of a driver who understands how to launch in a manner that won’t run afoul of the "antipowerhop" algorithms programmed into the engine controls software.

The revised LS6, with 405hp@6000 rpm and 400 lbs/ft.@4800 rpm, makes the ’02 Z06 a couple tenths quicker than last year’s model and a full, half-second quicker than the last of the ZR1s, which also had 405hp but carried almost 400 more pounds. At a ripe old age of 11, the ZR1’s only remaining title is "Fastest Production Corvette" at 180 miles per hour.



’02 LS6 vs.’01. Below 3750 rpm there is no practical difference between the two, but get on the loud pedal and let the motor rev through 4000 rpm and, trust us–you’ll feel the difference.
Chart: GM Powertrain Division
[Click Image for Larger View]

LS6 Evolution: Bigger Cam–Again

There are two big changes in LS6 for 2002. The first is evolutionary and the second is revolutionary.

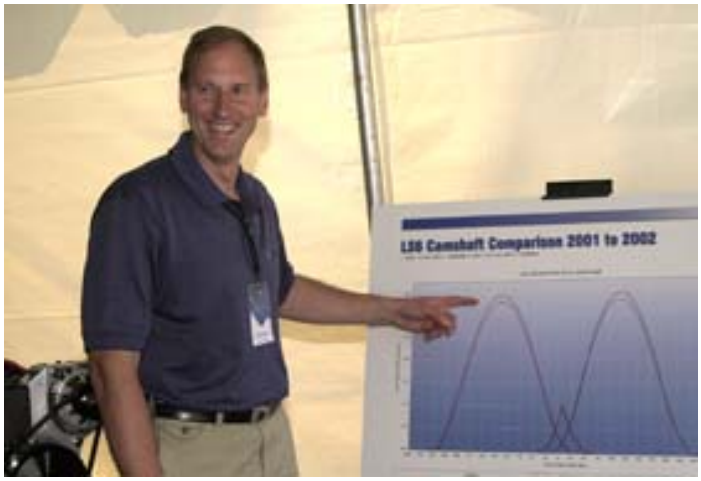
Looks like a steel billet, roller lifter camshaft for any GM small-block, right? Well, not so quick.
A big difference between Gen III cams and all small-block cams that have gone before is the Gen III's larger base circle radius. That allows both high cam lift and lower valve train loads. Both increase performance and durability. That said, both *LS6 cams*, have slightly *smaller* base circles than LS1 and truck cams.
Image: Author.
[Click Image For Larger View]

The '02 LS6 cam is an evolution of the .525-inch-lift, 2001 part. It's more aggressive profile has the highest valve lift, about .550-in., of any cam ever installed in a production small-block V8, Generation I, II or III. We interviewed John Juriga for this article and he said about the '02 cam, *"It required the most engineering because it's a fine balance to try and gain more airflow without disrupting emissions, loosing low-end torque or creating durability problems. We upped the lift from 13.3 to 14 millimeters on the inlet and went to 13.9 on the exhaust."*

We also spoke to the LS6 camshaft engineer, Jim Hicks, and he agreed. *"Yeah, it was a fairly large challenge. We were taking the valve lift velocity and acceleration up to a new level. We have never run anything even approaching 14-mm. in the small-block's history–not in a production application, anyway.*

"The most aggressive part of the profile is the intake event. We held the duration constant and increased the acceleration to get the added lift area. That was done to improve engine performance.

"The exhaust event–actually, we carried over the peak accelerations of the '01 LS6 cam and let the duration grow."



"Dr." John Juriga explains differences in LS6 cams to writers and reporters at the '02 LS6 preview last May. He had a lot to be happy about. The '01 Corvette Z06 the the LS6 engine was well-received. His Gen III passenger car engine team is at the top of its game with the 2002 LS6 and they've got more good things in the works. Image: Author.
[Click Image For Larger View]

LS6 Camshaft: Intake Comparison
(All lift figures are tappet lift)

year PN	int. lift	int. dur at .004	int. dur. at .050	int. open at .004	in. close at .004	in. open at .050	in. close at .050	int. CL	int. area	int. area increase
MY01 12560950	13.34 m .525 in	270°	204°	9° BTDC	81° ABDC	18 ATDC	42 ABDC	118° ATDC	1862.9 mm/ deg.	
MY02 12565308	14.01 m .551 in	267°	204°	7° BTDC	80° ABDC	19° ATDC	43 ABDC	120° ATDC	1936.9 mm/ deg.	4%

LS6 Camshaft: Exhaust Comparison
(All lift figures are tappet lift)

year PN	exh. lift	exh. dur. at. .004	exh. dur. .050	ex. open .004	ex. close .004	ex. open .050	ex. close .050	exh. CL	exh. area	ex. area increase
MY01 12560950	13.33 m .525 in	275°	211°	65° BBDC	30° ATDC	37 BBDC	6 BTDC	114° BTDC	1914.6 mm/ deg.	
MY02 12565308	13.91 m .547 in	282°	218°	69° BBDC	33° ATDC	42 BBDC	4 BTDC	115° BTDC	2046.6 mm/ deg.	8%

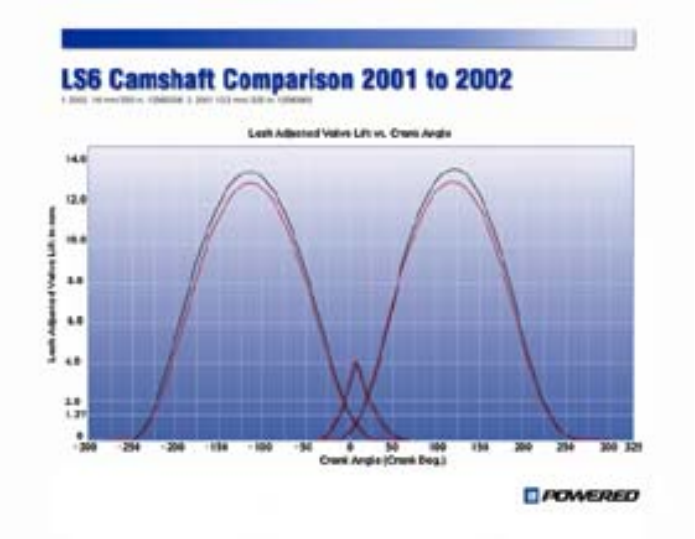
To preserve idle stability, the MY02 intake duration at .050-in lift was held to the '01 specification. Idle quality is a pleasability issue with Corvette customers, but more importantly, it impacts exhaust emissions. For LS6 to meet the national low emission vehicle (LEV) standard, it's got to idle smoothly. With the intake duration frozen, the only way to increase air flow and, thus, performance was to add valve lift.

The exhaust duration at .050 lift was lengthened and valve lift was added. Both increased exhaust port flow.

Another change made to preserve idle quality was to spread the lobe centerlines apart. *"We spread them by retarding the intake lobe two degrees and advancing the exhaust one degree,"* Jim Hicks said. *"Typically, when you delay the intake closing point, you give up a little torque at low speeds, but it doesn't hurt power. In fact, if anything, it might help power a little bit.*

"The main reason why they were spread like that is: with the longer exhaust duration, we had to spread the lobes to maintain overlap at the '01 LS6 level so the idle quality wouldn't be degraded.

"There was no downside from a power perspective and the torque really wasn't hurt either. We made up for it in the additional lift area."



The '01 and '02 cam profiles graphed against each other. MY01 is in red and MY02 is in black. The extra spike in the center is a 5x blow-up of the overlap area. The line at 1.27-mm.. lift represents the .050-in. lift the aftermarket cam companies use as a benchmark.
Chart: GM Powertrain Division.
[Click Image For Larger View]

Another major difference between 385-horse and 405-horse cams is the base circle radius. The base circle for the '01 LS6 is smaller than that of the LS1 and the truck cams and, for MY02, it's even smaller. Most Gen III cams have a 19.7-mm. base circle but the '01 LS6's is 19.3 and the '02's is 19-mm.. Both reductions were to accommodate increases in valve lift.

We asked Jim Hicks why the base circle had to get smaller when lift increased? *"All of our cams* (prior to LS6) *had the same base circle radius. We had a problem with that base circle, if we wanted to go to higher lifts: the nose of the cam would approach the same diameter as the cam bearing journals or even above them.*

"Obviously, that means you can't install the cam in the engine–little bit of a problem. Your only alternatives are to increase rocker arm ratio, which we weren't going to do, or reduce the base circle radius."

The '01 base circle reduction did not require a change in dimensions of any other valve train part, however, the 405-horse cam was a different story. "I wasn't comfortable reducing base circle that much," Hicks told us, "without compensating for it somehow, because the position of the plunger within the hydraulic lifter is not optimal any more–you're too high in the lifter.

"There's different ways to correct the geometry. The one we selected to minimize the impact on our manufacturing operations was to increase the length of the valve. The valves in the 02 LS6 are 0.6-mm. longer than the valves in all other Gen III engines."

With .025-in more intake lift, the same intake duration at .050-in but a little less duration at lash and the same rev limit; something had to be done to the rest of the valve train to keep it in control at high rpm. While the '02 exhaust lobe doesn't have quite the aggressive profile as the intake, it's still got more lift, so

something had to be done there, too. The choices GM made were to decrease valve weight and increase valve spring pressure.

"With the higher lift, we needed to reduce the mass of the valvetrain or start getting into a float condition," John Juriga commented. "We went to hollow stem intake and exhaust valves, very similar to what we used in the '96 LT4. We pushed the edge with a state-of-the-art, 0.8-mm. (valve stem) wall thickness–very thin stuff. The exhaust stems are sodium-potassium filled."

Not only are '02 LS6 valves taller, but these cutaways, made before the valve goes through the final machining steps, tell a bigger story: the significant mass reduction in hollow stem valves. The one at center right is the exhaust valve and its cavity is filled with the Sodium-Potassium compound. Image: Author
[Click Image For Larger View]

The '01 intake weighed 99 grams but the '02 weighs only 76. The '01 exhaust weighed 86 grams but the '02 exhaust weighs 63 grams. The exhaust stems are filled with a 78% potassium/22% sodium mix to help cool the valve. "NaK" is unstable and may spontaneously combust when exposed to air with 50% or higher humidity. *Do not* cut open or shorten 02 Z06 exhaust valve stems.

As a result of the more aggressive cam, the valve springs were, also, changed. *"Even with the lighter valves,"* Juriga said, *"we still needed better control because we open and close them very fast. The closed loads are the same–400 Newtons* (90lbs) *on the seat–but the open loads increase from 1150N* (259lbs) *to 1310N* (294lbs) *for both springs."*

A bigger cam, lighter valves, stiffer springs–so goes the ruthless pursuit of power. And–what's this new camshaft and valve train stuff worth, by itself? Jim Hicks: "You can do a direct a-b and there's an easy 8-10hp there, whether you change the back-pressure or not. There are other changes in the '02 package–exhaust system and induction system–which increase the power more. The overall power increased about 20hp and the cam was half of it. Again, that's because it's a short-duration design with low overlap so it's not really affected that much by back-pressure.

"In fact, we ran the ASA (the American Speed Association, an oval track racing spec. series that uses a modified version of the LS1) cam, back-to-back with this '02 LS6 cam. If you don't change the exhaust system, you only pick-up 2 hp with the ASA cam, but if you drop the back-pressure to something near zero (ie: a racing exhaust), then it's more like 20hp. So, that's the back pressure effect I keep talking about."

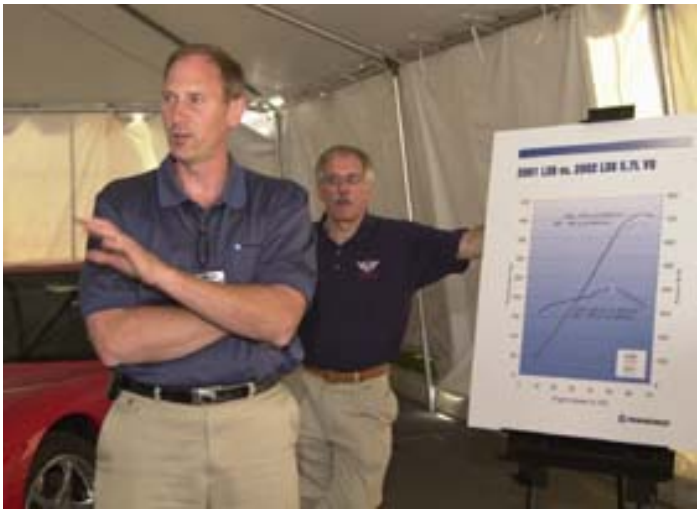
What about that ASA cam? It's got only .525-in. lift but, at .050-in., it's got 226° intake duration and 5.5° overlap versus the LS6's 204° and no overlap. Clearly, it's designed for higher rpm and more power but it needs a very low restriction or open exhaust. Will it work in a hi-po street LS6? Well–kinda sorta. Once you get the cam and the right valve train pieces, the biggest problem comes if you have to remain emissions legal. Getting the engine to run with the ASA cam but without the OBD2 diagnostics blowing codes would be a challenge you have to tackle–but only after you design a cat converter set-up and exhaust system that has low enough back pressure such that the ASA cam's potential can be realized.

What about updating '01 LS6es with the '02 cam? Don't do it, unless you add the '02 valves and springs. Why? "The biggest issue is:," Jim Hicks stated, "without the lightweight, hollow-stem valves, you loose

about 300-400 rpm in limiting speed. If you continue to run the LS6 calibration, where the fuel cutoff is 6600 rpm; you're gonna be running into some significant valve train distress at 6200-6300 rpm. I have no idea how durable that combination is going to be over time."

LS6 Revolution: Pups Out, New Cats In

The key enabler for the cam and everything else to work to the tune of 20 more horsepower was a revolutionary, new catalytic converter design.



During the ’02 Z06 press conference at Irwindale Speedway, John Juriga (at left) and Dave Hill explained a key enabler for the LS6 engine’s extra power was a new catalytic converter design that reduced exhaust restriction. Image: Author.

Last May, *The Idaho Corvette Page* interviewed Corvette Chief Engineer, Dave Hill, and John Juriga. Even before I fielded my first question, Hill made a statement refuting charges by some conspiracy theorists that GM has been delaying introductions of high-performance Gen III’s to enhance marketing.

"We never set out to obsolete the 2001 (LS6)" Hill told . *"The horsepower increase was possible only after we completed a lengthy development of a new catalyst. I want to set the record straight: the 2001 was the* best *Z06 we could possibly make and 2002 is better because new catalyst technology let us get the back pressure down, increase the breathing and make that power increase."*

"In 2000," John Juriga added, "*we had to meet the LEV standard here in California, so we added close-coupled convertors up front* (of the regular cats) *on the California package–our "pups" as we call ’em. In 2001 we carried those pups across-the-board, including on the LS6. Even while we were implementing that, we were working on a design that would eliminate those pups. This reduced back-pressure by two inches of mercury. On its own, that was worth about 5hp. That seems not much but, if you reduce back-pressure by even small amounts; you can make a bigger gain with improvements on the induction side, especially with the cam."*

Catalytic converters (aka "catalysts" or "cats") must reach and sustain a high interior temperature for the reaction necessary for the conversion of exhaust pollutants to occur. The period between engine start and cat "light-off" is the most difficult time from an exhaust emissions standpoint because the cat isn’t hot enough to work.

The Corvette "under-floor" cats were the same from MY97-01. To meet California LEV for MY00, Juriga’s team of engineers at GM Powertrain Division (GMPT) had to make cat light-off happen sooner and the solution for ’00 California cars and all ’01s was to move the catalytic reaction closer to the exhaust heat by adding small, close-coupled, catalytic convertors, or "pup cats", upstream of the under-floors and closer to the exhaust manifold outlets. While the official ratings did not change, ’00 California cars were probably about 5hp short of the ’97s, ’98s and ’99s because of the pups. MY01 had no deficiency because the LS1

was changed in other areas negating the pup's power loss.

Engineers call the interior structure, or "substrate," of a catalytic converter a "brick" because of its characteristic shape. The '97-'01 under-floor cat used a single brick having a combination of palladium and rhodium as its reactive ingredients. The '02 under-floor is a two-brick design. The front brick uses palladium and the rear brick uses a platinum-rhodium combination.

This new cat, along with changes in PCM calibration, allows the LS6 to meet LEV without pup cats and their exhaust back-pressure. There were other benefits of going pupless, too: less cost and a 5.5lb. weight reduction.

Anyone planning to upgrade an '01 Z06 to '02 specs is going to have to do more than just change the camshaft and valve train to get the full 20hp increase. They will need to remove their pups and upgrade to the '02 under-floor cats. If that's not done, they'll see only part of the increase.

Induction and Calibration Upgrades

More airflow from the new cam and less back-pressure from the new cats drove some other improvements on the induction side. For MY02, LS6 gets another, new air filter assembly. It's similar to the '01 unit, in that it has an additional air intake opening on its cover, but the extra opening is larger.

A side-by-side of the '02 and '01 air filter assembly shows their differences. Image: Author
[Click Image for Larger View]

GM did what *Idaho Corvette Page* regulars have been doing for years with MAFs–remove the air flow straightener or "screen". What took them so long to figure that one out? The LS6 is not GM's only application of that MAF. Any use of it with an air intake duct that curves just before the MAF (typical of most trucks), needs the straightener for the MAF to sense accurately and GM's conventional wisdom was to leave it in on Corvettes. In part, the essence of the ruthless pursuit of power is whipping conventional wisdom which was, according to Dr. John, *"....you gotta have it in there."*

With the Corvette's relatively straight passage between the air filter box and the MAF, the straightener isn't needed. Juriga told us it wasn't until the MY02 development that his people looked at that MAF in a Corvette-specific perspective*. "The questions we continually ask are: 'Do we need it?', 'What's next?' and 'What if?'*

"The low-hanging fruit is gone," Juriga continued, *"as far as changes that make more power so you gotta start going higher–you gotta go to the edge. That's what the Corvette is all about–pushing everything to the edge."*

There were no changes to either the LS6's intake manifold or its cylinder heads. John Juriga: *"The intake manifold was already pretty darn good. We designed it to handle additional flow rates and not require retool the very next year because composite intakes are very expensive to retool and develop. We made sure it would flow more air than we needed in the first year. The same was true with the heads."*

A change in engine air flow significant enough to provide 20 more horsepower also demanded a small change in the engine's fuel and spark curves. This was done with slight changes in the PCM calibration. There was no change in injectors or fuel pressure.

The two MAFs, screened and unscreened. That GM has done this for ’02 ought to prompt the folks who’ve yet to do it to older Gen IIIs to remove their screens. Removing the screen and using the ’02 air filter box together gets about 5hp at airflow levels such as the LS6’s.
Image: Author [Click Image for Larger View]

We mentioned the calibration’s antipowerhop algorithm earlier. Confronted with customer complaints and durability concerns about the behavior of manual transmission Corvettes at launch, GM Powertrain has added the feature to eliminate the hop. *"The Power Hop algorithm is used on manual transmission Corvettes, only."* John Juriga states. *"If TCS* (traction control system) *is turned off, it is possible to get the tires to break loose and have axle hop, or oscillate, during hard launches. To remedy this, the TCS module requests a torque reduction from the ECM, even though TCS has been turned off by the driver. For Power Hop, spark and/or fuel* (reductions are) *used rather than throttle to improve response time. This request is calibrated so wheel hop can be reduced as much as possible without compromising vehicle performance. The TCS module requests just enough torque reduction for just long enough to get the axle back on the ground during these launch events."*

Fixes for Oil Use and Piston Slap

A hot topic amongst Gen III-powered Corvette and F-cars enthusiasts, especially those active on the Internet, is high oil consumption. We asked Juriga about this and he confirmed there's a problem, but not one as widespread as some people believe. He also explained the fix GM Powertrain has developed for it.

"We have seen a greater percentage of complaints than we'd like about oil consumption," John admitted. *"The condition under which we get that oil consumption is high-rpm, light-load–like if you drive in a city schedule but never take the car out of second gear. In that situation, the piston rings can get into a flutter condition and that's when the oil consumption takes place."*

Piston ring seal depends on a balance of four forces: combustion pressure, ring inertia, the ring's radial expansion pressure and crankcase pressure. Ring flutter is uncontrolled oscillation due to an imbalance of those forces. Once a piston's rings go into flutter, their ability to scrape oil off the cylinder wall as the piston moves downward is impaired, blow-by increases and oil consumption rises dramatically.

The combination of high rpm and low crankcase pressure typical of low engine loads causes those four forces to become imbalanced. The small amount of '97-'01 LS1s and LS6es that see regular, high-rpm, light-load operation may suffer high oil consumption.

"The severity of this problem is specific to the driver," Juriga continued. *"You can take a car that is a major complaint for one customer and give it to another customer who'll have* (different driving habits and) *no complaints and get 5000 miles to a quart."*

The common sense is that sustained high-speed and light-load is not a normal duty cycle, even for an engine in a car like a Corvette. Who drives around town running 4000 or more rpm at light-throttle?

"It's not the way most people normally drive," John agreed, *"so it has not been a substantial part of our normal durability schedule.*

"It is *a substantial part of our schedule, now.*

"This particular problem is not something you see as a wear issue, either. You can tear apart the engine and find nothing. In fact, that's why it was so difficult. Someone says, 'I have an oil consumption problem.' We give the car to our guys who put a thousand miles on it and oil consumption is within limits. When we drive it aggressively, but in a more conventional manner, there's no problem. We tear down the engine. Everything looks fine. No wear. No scored bores. No ring gap alignment problem. Nothing to explain the oil consumption.

"This issue has become very pronounced on the Internet. People are saying, 'Oh–we've got a problem with oil consumption.' but the vast majority of customers don't have any problem. There are a few who drive like that–and they're entitled to, that's why they buy a Corvette. They are the ones that have trouble and we want to try to help them."

Internet conspiracy theories, urban legend and rumor mutate and spread rapidly. While the core issue, oil use, has factual basis; it quickly became exaggerated and laced with disinformation.

To verify a problem like this then develop and test a successful fix is difficult and time consuming. Initially, during the years the only engine was the LS1, complaints were limited in number and isolated. This is why General Motors has seemed slow to respond.

"Our investigation into those complaints took time," Juriga continued, *"due to the fact that driving style had been determined to be a factor.*

"The consumption became more pronounced with the higher rpm operating range of the ('01) *LS6 and, therefore* (it was) *possible for us to evaluate correctly. As soon as the* (test) *data came in from '01, we had an improvement for '02. Let the customer rest assured: the cases that have come in are from the non-typical driver. By far, most customers are not experiencing abnormal oil consumption.*

GMPT contacted customers experiencing the problem. This group was asked specific questions about driving habits. Once GM acquired data pointing at the difficulty, it devised a test schedule that could be run under controlled conditions and would include some high-speed, light-load operation. Once GM did that, then tore down engines and found no wear, materials or assembly trouble; ring-flutter-driven, oil consumption was identified as the cause.

[Above] The unique scraper face of the Napier profile, second compression ring, shown upside down for demonstration purposes, is clearly evident here. Image: Author. [Click Image for Larger View]

This is a side view of the scraper face on a typical second compression ring. Drawing: Author.

This is a side view of a second compression ring having a Napier profile face. Drawing: Author

"We went back to our ring supplier and worked with them in developing a fix," Juriga explained. *"We changed the ring pack. We use a higher tension oil ring. We went from a nine pound ring to a 13 pound ring. We also changed the second compression ring to a 'Napier ring' design which has a very pronounced scraper profile on it. The old second ring uses a conventional oil scraper design.*

"We implemented this for the start of production (MY02) *on LS6 and within a couple weeks afterwards, it went into the LS1, so it is across-the-board on both. "*This revised ring pack was validated, in-part, by field use in engines having trouble with high oil consumption under high-rpm/ light-load. The increased oil ring tension keeps the four forces mentioned earlier in balance so oil ring flutter is eliminated. While the '97-'01 second ring had a scraper face, the Napier ring is like a "super scraper-faced ring" and results in more aggressive oil control on the piston down stroke.

"We've had over a dozen customers with complaint vehicles," John Juriga stated. *"We put these rings in and it's a 'clean kill.' It takes customers who are aggressive drivers and who had oil consumption as low as*

500-800 miles per quart up to 1500-2000 miles a quart. This fix is available through the service organization. Dealers will disassemble the engines and change the rings.

"It's on a case-by-case basis because, with some customers, all you have to do is tell them, 'You can eliminate your problem if you throw it into third or fourth gear instead of riding it in second.' They'll be happy to do that and the problem goes away.

"Other customers say, 'No. That's why I bought my 'Vette. I'm gonna drive it the way I wanna drive it.' If so, that's fine. At this time, there isn't a threshold other than what is standard with our other engines. If a customer is experiencing oil consumption of more than a quart per 2000 miles they can have it reviewed by a GM dealer which then makes a determination as to follow up. If you're getting 500-800 miles per quart, that's too much and we're going to swap the rings out in that engine."

The revised ring package *will not* increase an engine's performance. If you're not experiencing excessive oil use, there's no advantage in running out to get new rings. If you do have an engine that experiences abnormal oil use due to some high-rpm/light-load operation; first, try modifying your driving habits a bit to eliminate any sustained operation like that, rather than immediately electing for the trauma of a partial engine overhaul under warranty. If eliminating most high-rpm/light-load operation doesn't stop excessive oil use, *then* ask GM to repair the engine.

Some involved in the public dialog about this issue have been critical of General Motors. It's our opinion that some of the harshest rhetoric is unfounded because this problem is not as common as Internet rumor claims nor does it stem from some coverup conspiracy to stick unsuspecting customers with substandard products. While it's clear to us General Motors erred in not making high-rpm/light-load testing as prominent as it should have been, thus, failing to detect trouble with ring-flutter; this issue does beg the question: should a small group of owners who subject their engines to the unusual duty-cycle of sustained high-rpm/ light-load operation share part of the responsibility for this problem?

Going to a higher tension oil ring and a Napier profile second ring solves the oil use problem convincingly. Will the change also result in oil consumption decreases in LS1s and LS6es which are driven normally or driven aggressively, but *not* in the high-rpm/light-load manner that previously caused ring flutter? There is that possibility.

In mid-April '01, there was a change in the LS1/LS6 piston which carried over to MY02. To address a limited amount of complaints about "cold piston knock", there was a small reduction in piston-to-bore clearance and new pistons, having skirts coated with a polymer, antifriction material, were introduced.

The two LS6 pistons. Because of the differences in piston-to-bore clearance, they are only interchangeable in one direction. You could use the new piston in a '01 LS6, but you can't use the old piston in an '02 LS6 block. Image: author.

The polymer antifriction material is not applied to the entire piston, only the skirts below the oil ring. Image: author. [Click Images for Larger View]

"When you decrease the piston-to-bore clearance, you're more susceptible to hot-scuff because you've got a tighter fit. The coating gives us resistance against scuffing," Juriga stated. When asked about possible power losses, he added, *"We haven't seen any measurable hit from a power standpoint because of the tighter clearance."*

The LS1/LS6 are first in the Gen III family to use coated pistons. Corvette often leads the way with new technology that eventually sees high volume production. In the near future, all Gen IIIs used in GM trucks will have coated pistons–we're talking millions of engines a year, here, not just 90,000 or so C5, Camaro/ Firebird and export (to Holden's in Australia) powerplants annually.

This piston knock anomaly that has been occurring in some '97-'01 engines after start-ups in cold weather is not a durability concern. It's a pleasability issue on which there was enough input from customers that GM made a production change. Like the revised rings, there's no performance advantage in switching to the tighter clearance and the polymer-coated piston. Those hearing a cold piston knock are better off ignoring it until the engine warms a little, rather than subjecting themselves to the stress of a dialog with a GM dealer intended to force repair or replacement of the engine.