Future Road Test: 2009 Chevrolet Camaro Vs. 2009 Ford Mustang

Virtual Smack-Down: America's Favorite Ponycars Dice In The Digital Domain

From the May, 2006 issue of Motor Trend

Chevy will build the Camaro. Oh, there's been no formal announcement, and the driveable concept car in these pictures is simply a fetching Frankenstein, cobbled from a Corvette engine, a CTS-v tranny, an STS-v rear end, etc. But take our word for it: It's all but a done deal. That means, of course, that the clock is ticking. And is there a more important match-up than Camaro versus Mustang? Chevy versus Ford, Round 347? It's only a question of time until some magazine ponies up a suitcase full of cash, a dossier of compromising auto-executive photos, or some other inducement to secure rights to the Exclusive First Camaro-Mustang Super Smack-Down.

But that could take years, and the PlayStation Generation demands instant gratification, so why not run the test now? At this very moment, we can reasonably assume such comparisons are running repeatedly on computers deep within General Motors, helping the Bowtie bunch perfect the Camaro's hardware and software for optimal acceleration, braking, and handling performance to guarantee victory over its archnemesis. And the Blue-Oval gang has undoubtedly started to develop and model its own Camaro countermeasures.

Motor Trend lacks the largess or the bribe-fodder to leverage printouts of either company's official results--corporate cutbacks and ethics codes are hell--but we're not afraid to cozy up to the experts who developed the best software for running such virtual comparos, and they agreed to help us simulate that momentous 2009 prize-fight.

Mechanical Simulation Corporation was born a decade ago to commercialize vehicle-dynamics software that had been developed during 30 years of research at the University of Michigan Transportation Research Institute (UMTRI). The original TruckSim program modeled the behavior of tractor-trailer rigs. CarSim and BikeSim have been developed and continuously improved ever since. Today the company has over 800 users in 20 countries working for 25 automakers and motorsport teams in Formula 1, NASCAR, and road racing. The secrets to CarSim's success are its simple graphic user interface and math equations that condense what would be thousands of independent variables, if one had to model each and every chassis component, down to around 1600 input parameters.

What We Think We Know
GM car-czar Bob Lutz is on the record stating that "if" GM were to build a Camaro, it would be designed to sell at volumes similar to the Mustang's--100,000 to 150,000 per year. He acknowledges that, to do so, it would have to offer an entry-level V-6 model priced just over $20,000. There'd also have to be an affordable V-8 model priced under $30,000. In response to questions about the Camaro concept's 25-horsepower deficit relative to Dodge's retro-muscle Challenger show car, he quipped that, should the need arise, the Corvette Z06's LS7 V-8 stands ready to outmuscle Dodge's Hemi by 80 horsepower. (Surely, Chevy will resurrect the hallowed ZL1 nomenclature for this modern-day all-aluminum 427.6-cubic-inch Camaro.)

We know the mainstream V-8 version--let's call it the Z28--won't get the LS2 Corvette engine shown in the concept car, although the current GTO has it, so anything is possible. Instead, sources suggest it'll run a closely related aluminum 6.2-liter like the one bowing in the 2007 Escalade, featuring cylinder-shutoff. It should twist the dyno needles to around 400 on the horsepower and pound-feet scales. The theory is, since Chevy is arriving late at the retro-muscle party, it had better make a splashy entrance, and 400 horsepower should trump the Mustang GT.

Don't expect the original ponycar to stand pat at 300 horses, though. Under Phil Martens, the Mustang team reportedly was readying a slew of special-edition 'Stangs, of which all have been canceled, we hear, except the "Boss" variant. Word has it that power for this big horse will come from a 5.4-liter version of the modular V-8 engine. Much Internet speculation suggests it'll pack the Australian "Boss 290" 32-valve 5.4-liter. That iron-block wonder develops 389 horsepower (290 kilowatts down under) and 384 pound-feet--a bit shy of the Camaro's anticipated output, but not so much that astute gearing, tire selection, etc. might give the Ford an edge. Shall we call it Boss 330, in keeping with Ford's local tradition of cubic-inch numeration?

Digital Development
When the idea for a new car like the Camaro has gelled enough to guess basic dimensions, suspension layout, and powertrain choices, the engineers can begin simulating its performance, testing different component options, and comparing the new car's dynamic behavior against that of its key competitors. The old-fashioned way to do this was to model every part of the car in the computer, assemble them, and run a simulation program on the supercomputer, perhaps overnight. Relative to casting and milling everything in real life this approach was cheaper and faster, but the extreme expertise required to develop the models, and the expensive supercomputer time, limited the number of design iterations.

Mechanical Simulation Corporation and some of its competitors (Milliken Research Associates, and Germany's Tesis and IPG, to name three), have sought to greatly simplify the simulation software so that engineers in the trenches can use it to develop chassis parts or systems on their own PCs. CarSim (and the closely related VehSim product customized for General Motors) sells for about $10,000 for a single-user license in the USA. The program hides all the complicated mathematics and ugly equations behind an elegantly simple Windows-based graphic interface that uses easily measured performance characteristics as the input variables. All suspensions are either independent or rigid axle, for example, and instead of entering complicated suspension geometries, the user enters the curves that describe how the camber, toe, caster, and other variables change throughout the range of jounce and rebound. These input variables are all chosen to match the output formats of the suspension test rigs on which competitive cars are measured and of the suspension design programs used by chassis engineers (like Knable & Associates' SuspensionSim).

Results are expressed as numbers in boring spreadsheets and as video animations, boasting video-game graphic quality. When comparing two cars, or two differing versions of the same development car, the faster car can appear to melt out of the slower one. Or ghost images of the cars can trail one another. Simple clicks with the mouse allow the viewer to zoom in, out, and around the action, too. Visit motortrend.com to play with the animations of our virtual tests to fully appreciate the power of this tool.

Assumptions
We started by gathering a full set of actual test data on a real 300-horsepower Mustang GT and rounding up all the dimensions and suspension parameters we could find on the production Ford and the concept Camaro. There's a remarkable amount of data available on the Internet if you know where to look (none of which is 100-percent trustworthy), but many variables on both cars still had to be guesstimated from scratch. In cases where information was missing for both cars, an approximation was tailored to make the Mustang simulation match the real-world test data and then applied equally to the Camaro as well.

The biggest single unknown variable is the tire performance. CarSim needs some esoteric data, like longitudinal and lateral tire forces versus slip angle, camber thrust, and tire spring rates. That's all well beyond what TireRack or the manufacturers publish, so CarSim guru Phil Mather rounded up figures for similar performance tires, tweaked them on the Mustang GT model, and applied the same properties to all versions of the Camaro and Mustang, varying the tire sizes to fit. Drag coefficient and frontal area are the next most difficult parameters to guess. Ford doesn't share its aero stats, and the Camaro has never been near a wind tunnel, so rather than guess at factors for two cars that might be wildly different, we ran both cars "in a vacuum," with no wind resistance at all. All simulated times to speeds above 60 mph will therefore be artificially low.

Complete engine performance maps for the Mustang engines, the Corvette LS7, and the 3.9-liter GM V-6 were scaled from manufacturer power and torque curves measured at wide-open throttle; GM supplied engine map data for the show car's 540-horse LS2 engine, which was scaled down to match the expected production 6.2-liter's power and torque peaks. A limited-slip differential with a 75 pound-foot preload was assumed for all V-8s; the V-6s run open diffs. Spring and damper rates were provided for the concept Camaro and scrounged for the Mustang GT, and then applied to all versions of both cars, absent any better information. Ditto the brake systems. We know the ZL1 and GT500 will have stiffer suspensions and bigger brakes, but we can't accurately guess by how much, so expect better performance from the real versions of those cars.

To illustrate how a tiny change in any of the parameters can have unforeseen effects on performance, senior development engineer David Hall ran a CarSim animation showing two Porsche 911 Turbos, identical except for slightly different antisquat geometry. The more level car's aerodynamic advantage helped it win a drag race decisively. This also helps illustrate that CarSim is an engineering tool, not an entertainment device. Video games like GT4 may do a reasonable job of mimicking a car's measured behavior, but CarSim accurately predicts it. Still, with all the guesses in play here, we can guarantee "your results will vary."

Race Day: The V-6s
Enough technobabble. Let's run 'em.
Our computers suggest Chevy will win the battle of the sixes decisively at the drag races. The Camaro enjoys a two-pound/horsepower weight advantage and, if the Solstice's five-speed transmission and 3.91 axle ratio make the cut, it'll also have 13-18-percent-shorter gearing, which pays off in a solid 0.6-second lead to 60 mph and through the quarter mile. Fuel-economy concerns will probably force adoption of a taller axle, which may erode but not erase the Camaro's lead. The skidpad and braking performance predictions may serve as vindication of Ford's live rear axle design, which does a remarkable job of keeping the rear tires perpendicular to the pavement on smooth surfaces. That's the only obvious explanation as to why the Mustang outgrips and outbrakes a Camaro that weighs the same, rides on the same tires, and has slightly larger brakes. The cars are in a dead heat on the figure-eight course.

The Mustang's gearing appears slightly better suited to the speeds running on that course, but the Camaro's increased roll control helps it better manage the transitions. The multilink rear suspension may also help the Chevy scoot through the slalom 0.7 mph faster at 68.4 mph.

	Camaro	**Mustang**
Engine type	60° V-6, iron block/ alum heads	60° V-6, iron block/ alum heads
Valvetrain	OHV, 2 valves/cyl	SOHC, 2 valves/cyl
Displacement	236.7 cu in/3880cc	244.7 cu in/4009cc
Power (SAE net)	240 hp @ 5800 rpm	210 hp @ 5250 rpm
Torque (SAE net)	240 lb-ft @ 2800 rpm	240 lb-ft @ 3500 rpm
Weight to power	14.2 lb/hp	16.2 lb/hp
Transmission	5-speed manual	5-speed manual
Axle/final-drive ratios	3.91:1 / 2.85:1	3.31:1 / 2.42:1
Tires, f;r	235/55R17	235/55R17
Curb weight	3400 lb	3400 lb
Simulated acceleration to mph		
0-30	2.8 sec	3.2 sec
0-40	3.7	4.3
0-50	4.9	5.4
0-60	6.2	6.8
0-70	7.6	8.4
0-80	9.5	10.3
0-90	11.5	12.3
0-100	13.6	14.6
Quarter mile	14.5 sec @ 104.4 mph	15.1 sec @ 101.8 mph
Braking, 60-0 mph	125 ft	122 ft
600-ft slalom	68.4 mph avg	67.7 mph avg
Lateral acceleration	0.82 g avg	0.84 g avg
MT figure eight	27.0 sec @ 0.69 g avg	27.1 sec @ 0.67 g avg

Round II
Chevy Camaro Z28 vs. Ford Mustang Boss 330

By far, our closest drag race was the Z28 versus the Boss 330. The Chevy launches about two-tenths quicker than the Mustang and just manages to hang on to most of that lead through the quarter mile. Credit its larger tires. Gearing and engine characteristics are quite different between these two cars, and it's possible that obtaining more precise engine-map data might widen the Camaro's lead. Certainly the Chevy's 200-pound weight advantage and 11 to 23-percent-shorter gearing would suggest a healthier straight-line performance margin than our computer predicts. Those larger tires afford a clear advantage in lateral grip (0.89 versus Mustang's 0.85 g) and assisted by the limited-slip differential, the bigger tires also help put more power down in the slalom test (where the Camaro's lead increases to 3.8 mph) and on the figure-eight course. In that maneuver, the Z28 drives away from the Boss on the straights, then the Mustang brakes a bit harder heading into the turns, catching up on the transition into the skidpad and hanging right with the Z28 through the curves But the two straights are long enough to give Chevy a clear 0.6-second advantage.

Championship Bout
Camaro ZL-1 vs. Shelby GT500
These super-ponies are stretching the envelope of our test assumptions, most of which are geared to the Mustang GT, so more grains of salt are to be taken with these results. Recall that we haven't stiffened the springs or dampers for this simulation, so a GT500 is unlikely to heel over as much as the one pictured below. We quadruple-checked all our known variables, but assumptions somewhere in the system have helped Ford beat the odds again. There's just no logical way to explain how the GT500, with a 30-horse power deficit, runs virtually neck-and-neck with the top-dog Camaro while carrying 300 extra pounds of iron block, cams, valves, and supercharger plumbing. That extra weight helps explain the drop in lateral grip from the Boss's 0.85 to the GT500's 0.83 g. Bigger tires increased the slalom speeds of both top dogs, but the 3.8-mph increment between them remains. All the Mustangs in our simulation permit more body roll than the Camaros do, which, along with the heavier Ford engines (limiting their eagerness to turn), conspires to keep slalom speeds low. And in the figure eight, traction limitations inherent in the suspension and tire assumptions prevent the increased power from paying off in lower lap times. Instead, the ZL-1 performs exactly like the Z28, and the GT500 improves on the Boss's time by 0.2 second. This was a close one.

	Camaro ZL-1	**Shelby GT500**
Engine type	90° V-8 alum	Supercharged 90° V-8, iron

	block/ heads	block/alum heads
Valvetrain	OHV, 2 valves/cyl	DOHC, 4 valves/cyl
Displacement	376.1 cu in/6162cc	330.4 cu in/5414cc
Power (SAE net)	505 hp @ 6300 rpm	475 hp @ 5500 rpm
Torque (SAE net)	470 lb-ft @ 4800 rpm	475 lb-ft @ 4500 rpm
Weight to power	7.1 lb/hp	8.2 lb/hp
Transmission	6-speed manual	6-speed manual
Axle/final-drive ratios	3.73:1 / 2.13:1	3.55:1 / 2.24:1
Tires, f;r	275/35R18; 325/30R19	255/45R18; 285/40R18
Curb weight	3600 lb	3900 lb
Simulated acceleration to mph		
0-30	1.7 sec	1.6 sec
0-40	2.1	2.1
0-50	2.8	2.8
0-60	3.4	3.5
0-70	4.2	4.3
0-80	5.2	5.3
0-90	6.2	6.4
0-100	7.3	7.6
Quarter mile	11.4 sec @ 130.5 mph	11.6 sec @ 128.2 mph
Braking, 60-0 mph	121 ft	120 ft
600-ft slalom	71.5 mph avg	68.4 mph avg
Lateral acceleration	0.88 g avg	0.83 g avg
MT figure eight	25.8 sec @ 0.75 g avg	26.2 sec @ 0.74 g avg

Conclusions?
If our simulations are at all accurate, we'd counsel Ford to increase its roll-control, providing that could be done without wrecking the ride (which we didn't measure here). We'd also encourage the Boss and GT500 to go on a serious diet. We wouldn't recommend ditching the Mustang's live axle for an independent rear suspension, though. We tried running several of the handling tests on rough pavement in hopes of upsetting the Mustang more than the Camaro but had no such luck. Ford's efforts to lighten the rear axle and improve its geometry have evidently paid off.

We'll go way out on a limb and predict that unforeseen developments, perhaps being wrought on simulation software right now in cubicles throughout GM, Ford, and the supplier community, will ensure that the real-life performance of the various Camaro and Mustang variants (and probably the Dodge Challenger, too) will end up as closely matched as our admittedly flawed computer models predict. When that happens, remember: You read it here first. But one thing no computer program we're aware of can predict is whether any Camaro or Challenger--no matter how attractively styled, or athletic, or beloved by magazine editors--will ever manage to outsell the Mustang and earn the title of America's favorite ponycar. For that, we'll all have to wait for 2009. n

Play the sims for yourself! Click on motortrend.com to watch the Camaro and Mustang dice on the dragstrip, slalom, and figure-eight in a 3D virtual environment.

It's All Happening In The Tube
Modern transportation boils down to bits and bytes
Computers can now simulate virtually every aspect of vehicle design, development, and production. Programs such as Alias allow stylists to evaluate many styling concepts, spinning them in virtual courtyards or driving them down winding lanes with light and scenery reflecting off their surfaces before any clay is modeled. Computers predict crash performance with amazing accuracy. Countless different programs are used to model and analyze every minute detail of an operating engine, right down to things like the size and motion of airborne oil droplets to help design oil separator baffles in a PCV valve. Once an engine is designed, programs like Magmasoft predict the flow of molten metal into the casting molds.

Other programs ensure that service parts can be removed and replaced without yanking the motor. Similar electronic aids are employed in the design of every subsystem, and when it comes to putting them all together, the factory is even designed in the tube to optimize the order and efficiency of the zillions of assembly operations required to build a car. Even the train and truck rides from the factory to your dealer are simulated to ensure against fatigue damage of the tie-down points, engine-mounts, etc.