

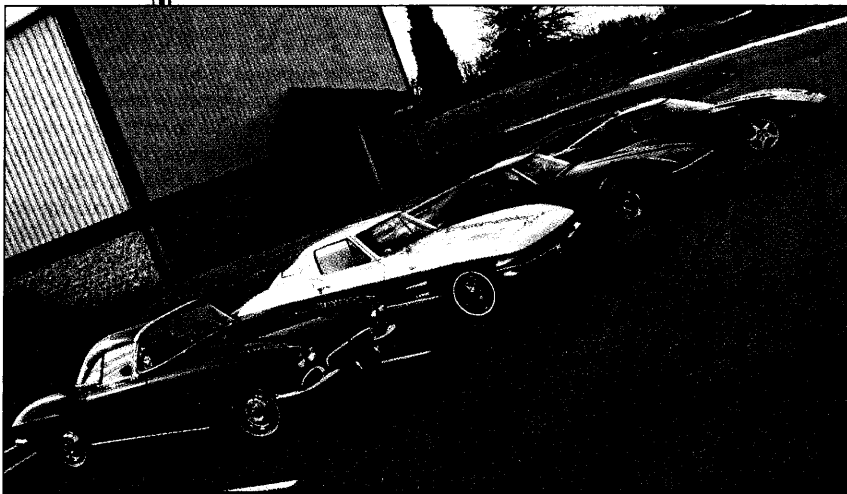
**IF AMERICA** has an iconic supercar, it has to be the Corvette. Yes, there are other candidates, but none seem to be able to withstand comparison. The Viper comes close but is still just a bit too rough around the edges. Ford's GT40 hasn't been produced for 40 years, and production of the modern GT didn't last but two. The Saleen S7 is still so exotic that only the most obsessed car nuts have ever heard of it. And the Camaro and Mustang are beloved but fall short of the Corvette in terms of performance and power.

The truest test that the Corvette is America's greatest sports car is simply to take a look at its mythic status. Ever since Zora Arkus-Duntov got his way and crammed a V-8 into the fiberglass-bodied two-seater in 1955, the Corvette has generated a mythology that no other American car can match. Yes, there have been issues like cheap plastic interior components, creaks and rattles, and the dol-drums that were the '70s, but every long-lived car has its growing pains. But something, somewhere along the way has clicked with the American public. Maybe it's the unique styling or the fantastic lineup of great engines that have been found between the fenders. Whatever it is, the Corvette is still a car that just about any grandmother that doesn't know a camshaft from canola oil can identify. It's also the car that most of us mooned over as teenagers. Oh, and hey, it's a very unscientific fact that a Corvette can help an average guy get a date with the pretty girls. God bless America.

With that in mind, we were very interested when we learned that Gary Eaker, owner of two of the few public wind tunnels in America, was willing to run a few Vettes through one of his facilities for us. Eaker's first wind tunnel, the AeroDYN facility in Mooresville, North Carolina, stays booked up with Sprint Cup race teams, so he recently built a smaller tunnel—dubbed "A2"—right beside of it. Although NASCAR teams also use it, Eaker says its primary purpose is for more budget-minded racers—everyone from Saturday-night oval trackers, to drag racers, to land speed racers. (For more information, check out [www.a2wt.com](http://www.a2wt.com).)

A trained aerodynamicist really only cares about the numbers, but Dave Salazar, A2 Wind Tunnel's general manager, broke out the smoke machine after we finished each test to help us actually see what the air was doing as it moved over and around each generation of Corvette.

**HAS MORE THAN A HALF CENTURY OF CORVETTE  
STYLING EVOLUTION IMPROVED THE CAR'S PERFORMANCE,  
OR IS IT ALL JUST FOR LOOKS?**



You've got 55 years of history when it comes to Chevrolet's Corvette, but have the styling changes over time really resulted in a better car? Only by spending days cooped up in a wind tunnel can you tell for sure. Hey, we're here for you.



The removable hardtop on the '62 C1 has a lip where the windshield meets the roof that is easily 1.5 inches tall. You can see here how it not only disrupts the airflow as it travels up the windshield, but also causes it to separate from the roof. Then, when it does reattach to the roof midway back, it's very turbulent. This is a major cause of the C1's poorer lift and drag numbers.



The change to hide-a-way headlamps with the introduction of the C2 produced a cleaner look when driving during the daytime, but notice the car's high parting line. Any air passing below the level of the smoke goes beneath the car, causing both lift and drag. One styling cue that's helpful, however, is the humps over the wheelwells. They keep the air from sliding off the top of the car and down the sides where it can cause more drag.

On off days, he'll even host something completely out there, like comparing every generation of Corvette back-to-back-to-back.

## THE TESTS

Dave Salazar, A2's general manager, and Tunnel Operator/Technician Bob Smith handled all the nuts and bolts of running eight Corvettes through the tunnel in a span of two hectic days, making sure that all the results were comparable. They also handled the time-consuming chore of lining up the cars for the tests.

The tests for all cars (called "blows" in wind-tunnel jargon) were performed at 85 mph thanks to four fans and 640 hp worth of electric motors pulling air across the cars. The A2 tunnel also uses a special floor in the test section to simulate the aerodynamic effect of the road surface moving underneath the car. In case you doubt these guys take their job seriously, they also made the effort to set the air pressure at 30 psi in every tire on every car that rolled through the tunnel. Finally, each car was tested in three different configurations: empty, with two passengers to simulate a more realistic road-going attitude with weight in the seats, and with two passengers and the headlights exposed (if applicable).

## GENERATION ONE

The first generation of the Corvette, the C1, was manufactured from 1953 until 1962. Our test car was a '62 all-original Corvette owned by Ben Horack. This first-generation model had the removable hardtop, which was in place for the tests. The C1 was also unique among Corvettes—until the C6 showed up—because it has fixed headlamps that can't be hidden away when not in use.

Interestingly, although it's the smallest overall, the first-generation Corvette has the greatest frontal area of any of the cars we tested. As you might expect just from looking at the more angular body lines, it also has the greatest coefficient of drag area (CDA) at 10.11. Surprisingly, it didn't produce the worst lift numbers. While the C1 recorded 124.6 pounds of lift at the front end (with passengers), the C2 recorded a higher 146.0 pounds of lift, substantially increasing the lift by 21.4 pounds. With the C2 headlights up, the lift increased another 7.2 pounds to 153.2, the highest lift numbers of any Corvette in the tests.

Although the first iteration of the Corvette doesn't fare well aerodynamically against its younger brothers, Eaker says the design is actually very effective compared to its contemporaries. "It's really impressive what they were able to do with those early Corvettes," he says. "Given the technology available at the time, coming up with a good aerodynamic

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package would have to have been a lot like watching a baseball game through a knot hole in the fence where you can only see left field and trying to figure out what's going on everywhere."

### GENERATION TWO

The next generation of Vettes, the C2, was produced from 1963 until 1967. This is the famous Stingray designed by Larry Shinoda. Our test car was none other than a '63—the only year of the famous split rear window—owned by John Meadows. Again, the car was all original with a 327 engine and four-speed transmission.

The C2 Corvette is the first with hide-away headlamps, so we tested with the lamps both down and up (with passengers) to see how that affected performance. As you might expect, running with the headlamps up increased drag considerably, increasing the CDA by 0.50, but it was worse in other generations. "Headlights are a necessary evil," Eaker says. "They can ruin the look of a car and aren't usually good for aerodynamics, but driving at night is already tough enough, so we don't want to get rid of them. Creating hidden headlights was one of the best-available solutions at the time, and it really became a Corvette trademark until this latest generation."

The C2's overall look is much sleeker, and the fastback reduces both drag and lift over the rear wheels at speed compared to the C1. The change in appearance is so dramatic, however, you really don't need a multimillion dollar wind tunnel to tell you that the second-generation Corvette is a vast improvement over the first.

### GENERATION THREE

The Corvette C3, like just about everything else produced in the '70s—with the possible exception of all those *Charlie Brown* specials—feels a bit dated. But slowly, the third-generation Corvette, produced from 1968 until 1982, is beginning to be accepted as a classic instead of a poorly engineered sports car with more bad taste than horsepower.

It's true that this generation of Corvette struggles in comparison to the other generations. The quality of materials often isn't what you'd expect. The engines were anemic (in 1975 the base 350 was rated at 165 hp) and the handling also dipped, as the cars gained weight thanks to the addition of catalytic converters, 5-mph bumpers, accessory packages like air conditioning, and other factors.

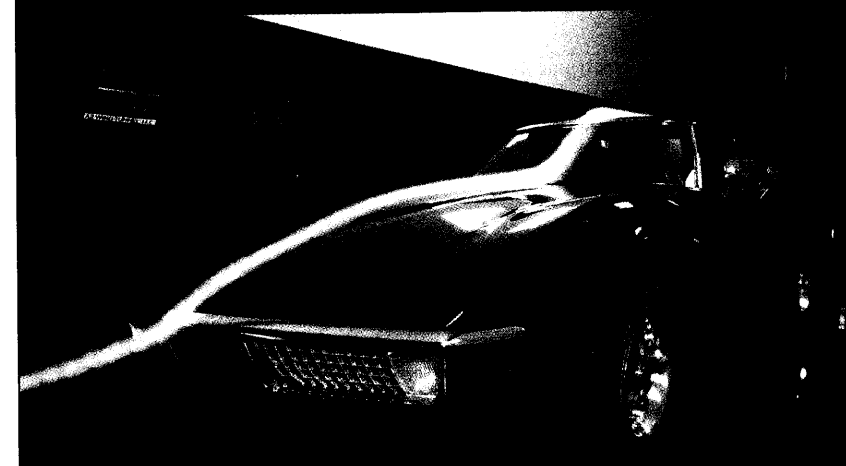
Eaker says you shouldn't completely blame Chevrolet's engineers for the lackluster image of the Vette in the '70s. "Those Corvettes are really a victim of their era," Eaker says. "In the '70s, society began demanding things of cars that it never had before—such as collapsible



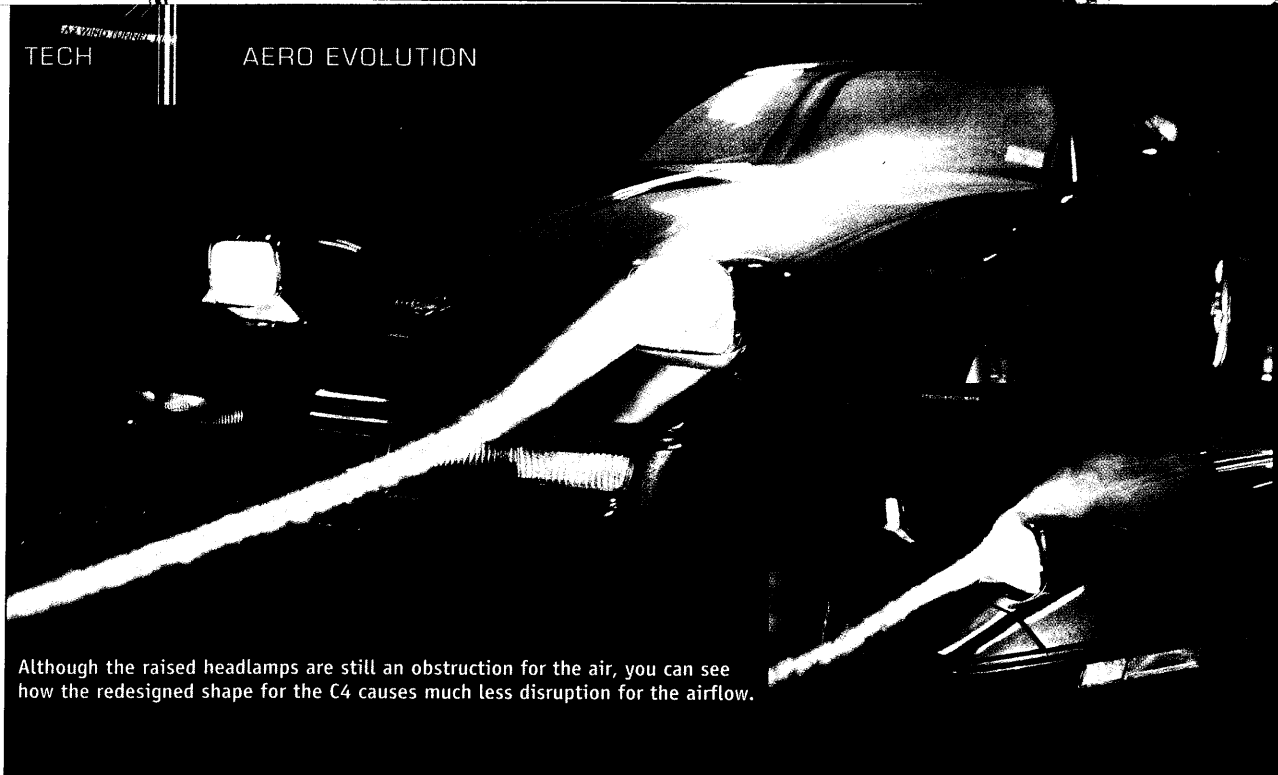
The addition of a fastback rear also helps move air fairly smoothly to the rear of the car.



When the headlamps are raised, the C2 becomes a much different car. The vertical wall created by the headlights not only causes drag, but notice how the airstream separates from the car and doesn't reattach until midway up the hood. The area between the smoke and the car is a low-pressure zone that causes lift at the front wheels. This photo (along with all the smoke tests) was taken with the wind blowing 35 mph; it only gets worse as the car moves faster.



The C3's smoother contours help the air follow the body of the car much more closely, but the split at the nose is still very high.



Although the raised headlamps are still an obstruction for the air, you can see how the redesigned shape for the C4 causes much less disruption for the airflow.

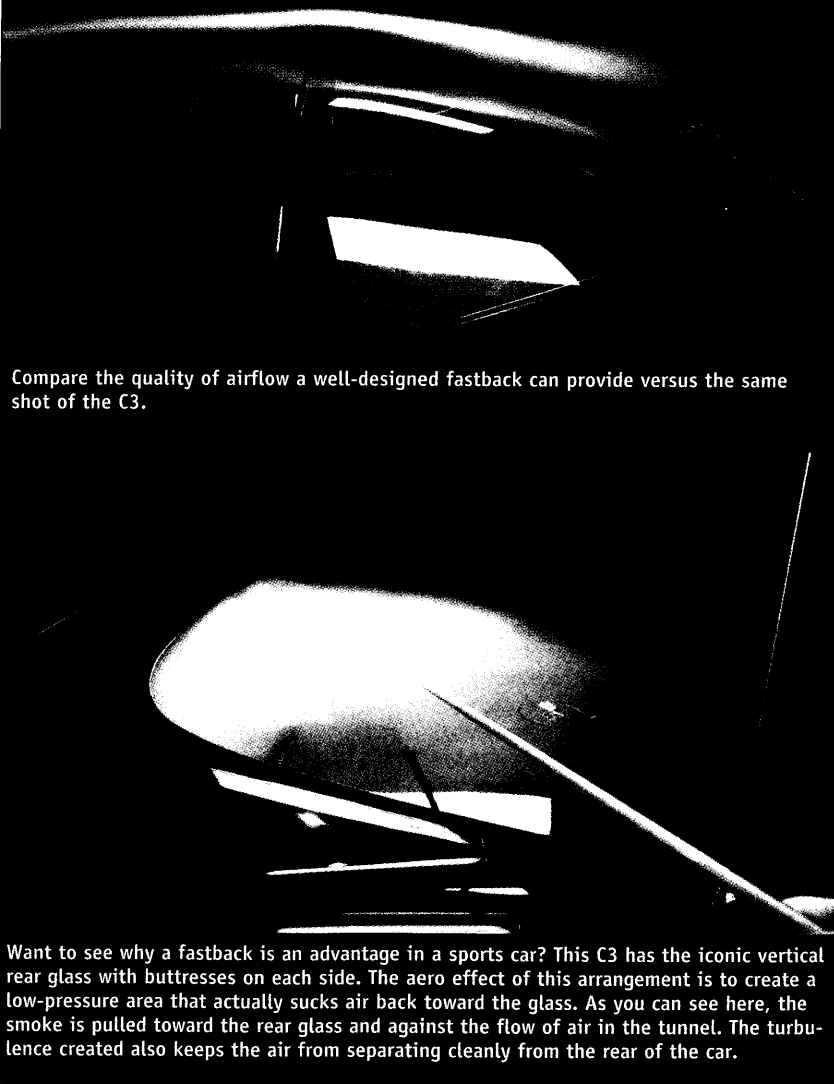
bumpers, better fuel economy, and less-polluting engines. The technology available at the time just wasn't able to keep up. The C3 wasn't as much fun as the C2 mainly because it had to do so many more things—like actually protect you in a crash."

Aerodynamically, the C3 we tested, a '70 model owned by Robert Morgan, doesn't differ much from the C2 split window. In fact, with the headlights up, it actually produces more drag (9.09 to 9.73 CDA). The addition of the tiniest rear spoiler, however, did help produce 13.9 pounds of downforce in the rear (shown as negative lift on the chart). This is the only car that was able to produce negative lift numbers.

## GENERATION FOUR

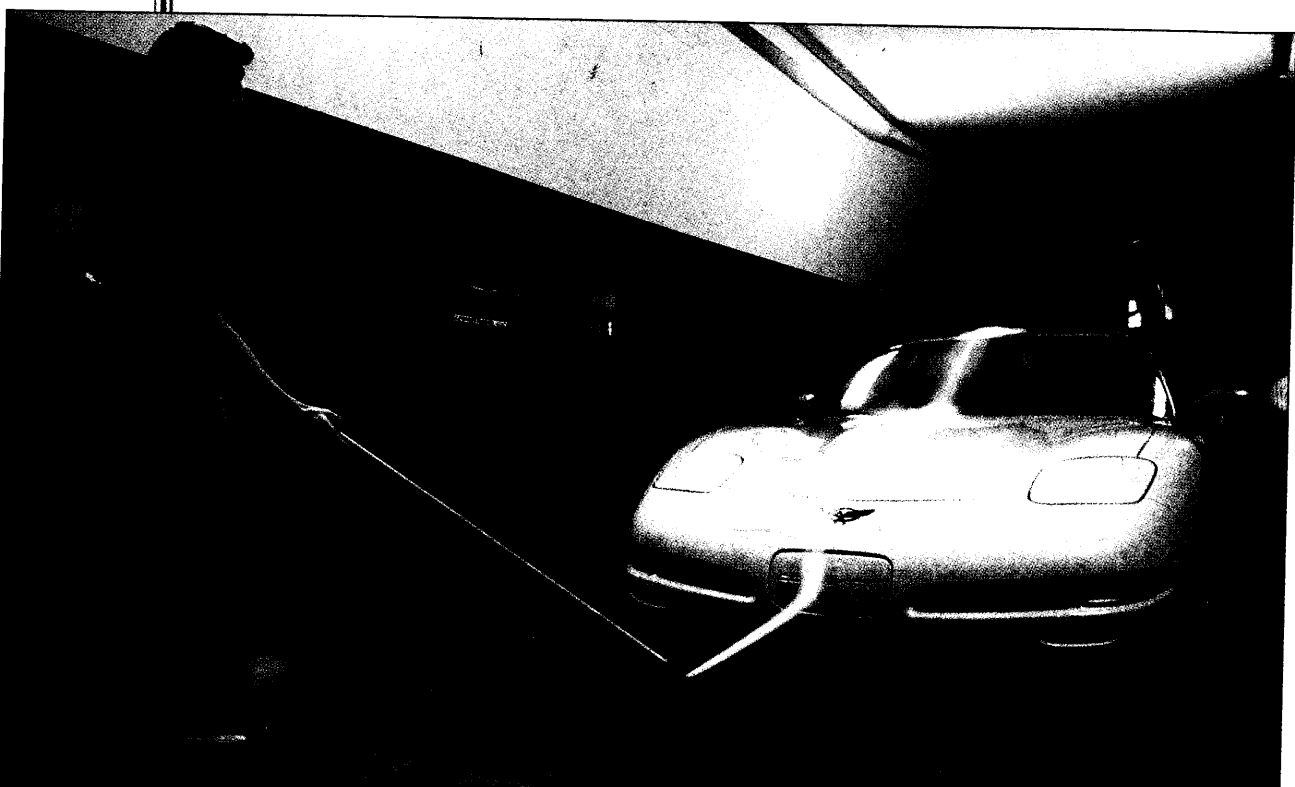
The beginning of the "modern era" Corvettes began with the C4 (1984-1996). Fuel injection standard, electronic displays in the dash, the now-famous wedge body design—you name it. The '84 model marked the first complete redesign of the Corvette since 1968, and it showed. Just about everything on this car is an improvement over the previous generation, and that includes the aerodynamic performance.

Incidentally, the '90 C4 owned by John Walton is the ZR1 model outfitted with the four cam/32-valve LT5 engine producing 375 hp. Although the body differs from the base model, the overall effect in the wind tunnel should be minimal. The ZR1 C4, however, improved the CDA over the previous generation drastically. The numbers come in at 7.46 for the C4 versus 8.81 with no passengers and the headlights down. And where the C3 increased the CDA by 1.04 just by flipping



Compare the quality of airflow a well-designed fastback can provide versus the same shot of the C3.

Want to see why a fastback is an advantage in a sports car? This C3 has the iconic vertical rear glass with buttresses on each side. The aero effect of this arrangement is to create a low-pressure area that actually sucks air back toward the glass. As you can see here, the smoke is pulled toward the rear glass and against the flow of air in the tunnel. The turbulence created also keeps the air from separating cleanly from the rear of the car.



By moving the parting line to the bottom of the bumper cover like on this C5, more air is forced up and over the car, decreasing both lift and drag.



Even though side mirrors can be made to minimize drag by making them a bullet shape, they still cause significant turbulence in the area directly behind the mirror.

Have you ever noticed on NASCAR Sprint Cup cars the sharp edge where the rear quarter-panel meets the back of the car? That's a trick that has been used for years in racing to help the air flowing down the side of the car to separate cleanly from the body with a minimum of turbulence. Corvette designers used the same concept here.

up the headlights, the C4 only increases by 0.61. Total lift is also nearly cut in half. The C4 cuts the C3's 136.2 pounds of lift all the way down to 69.3.

**GENERATION FIVE**

Finally, we reach the C5, a generation new enough that some purchasers are still making payments. Produced from 1997 until 2004, the C5 is again a tremendous

improvement over the previous generation. Its introduction also marked the debut of the LS1 engine, which has become a favorite of hot rodders everywhere not only for the power it produces, but also for its light weight thanks to all aluminum construction. The C5 not only lost weight versus the C4, it was also better positioned thanks to relocating the transmission back to just in front of the rear axle.

For the C5, we tested two different models. The first was a standard-edition Vette owned by Mark Connolly. The second was a Z06 owned by Tommy Megremis. Surprisingly, the baseline Corvette produced better aero numbers both in terms of drag and lift. Because it has a greater frontal area, the C5 Z06 actually has slightly more drag than a C4 Corvette. Much of this apparently comes from the

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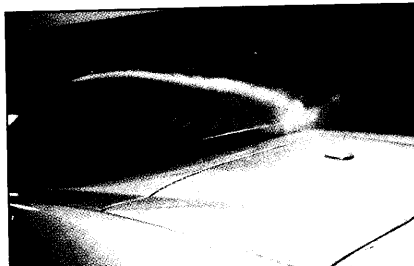
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## ACCUMULATIVE C1-C6 AERO BREAKDOWN

COMMENTS	FRONTAL AREA	CD	CDA	DRAG		LIFT		L / D	LIFT	
				HP	LB	TOTAL LBS	FRONT LBS			REAR LBS
C1 Corvette Baseline	22.0	.459	10.11	42.3	186.8	160.3	111.7	48.6	0.9	69.7%
C1 Passengers	22.0	.452	9.93	41.6	183.6	171.8	124.6	47.3	0.9	72.5%
C2 Split-Window Baseline	20.0	.431	8.62	37.0	163.3	188.2	141.0	47.2	1.2	74.9%
C2 Passengers	20.0	.429	8.58	36.8	162.5	191.6	146.0	45.6	1.2	76.2%
C2 Headlights up	20.0	.455	9.09	39.0	172.3	186.8	153.2	33.6	1.1	82.0%
C3 Baseline	19.3	.456	8.81	36.9	162.8	122.5	113.5	9.0	0.8	92.6%
C3 Passengers	19.3	.450	8.69	36.4	160.6	128.0	117.0	11.0	0.8	91.4%
C3 Headlights up	19.3	.504	9.73	40.7	179.8	136.2	150.1	-13.9	0.8	110.2%
C4 Baseline	19.3	.387	7.46	31.3	137.9	67.0	55.3	11.7	0.5	82.6%
C4 Passengers	19.3	.371	7.16	30.0	132.4	73.4	62.6	10.8	0.6	85.2%
C4 Headlights up	19.3	.403	7.77	32.6	143.7	69.3	61.1	8.2	0.5	88.2%
C5 Z06 Baseline	20.7	.373	7.71	32.3	142.5	95.8	67.1	28.7	0.67	70.1%
C5 Z06 Passengers	20.7	.359	7.44	31.2	137.5	100.0	74.6	25.5	0.73	74.6%
C5 Z06 Headlights up	20.7	.411	8.51	35.6	157.3	108.8	90.5	18.3	0.69	83.2%
C5 Baseline	20.7	.334	6.92	29.1	128.6	84.8	48.0	36.8	0.66	56.6%
C5 Passengers	20.7	.323	6.69	28.2	124.3	93.1	58.4	34.7	0.75	62.7%
C5 Headlights up	20.7	.372	7.70	32.4	142.9	96.8	69.5	27.3	0.68	71.8%
C6 Convertible Baseline	21.0	.359	7.54	31.6	139.3	76.5	58.0	18.5	0.5	75.8%
C6 Passengers	21.0	.353	7.41	31.0	136.9	86.2	65.5	20.7	0.6	76.0%
C6 Baseline	21.0	.343	7.20	30.1	133.0	88.5	67.7	20.8	0.67	76.5%
C6 Passengers	21.0	.333	6.99	29.3	129.1	96.2	75.2	21.0	0.74	78.2%



The convertible C6 did have aero disadvantages compared to the hardtop C6, but it may not all be blamed on the cloth top, which fits snugly to the windshield and is relatively smooth. One culprit may be the sharply sloped rear glass.

Z06's redesigned nose. It contributed to more aero lift on the front end versus the standard model, while the Z06 had considerably less lift at the rear end.

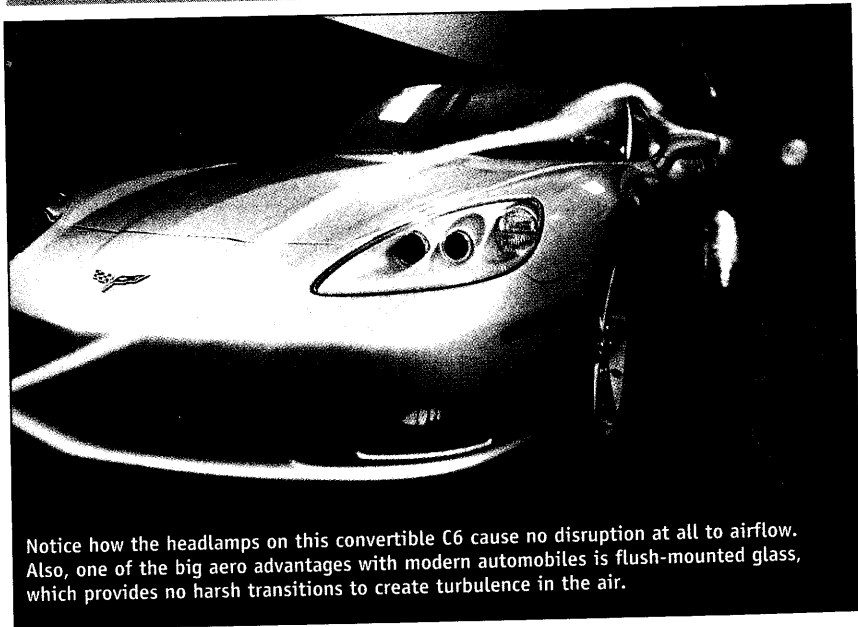
"As a general rule, the base model of any car will have less aerodynamic drag," Eaker says of the surprising differences. "That's because the designer's higher priority is maximizing fuel mileage by reducing wind resistance. Option, or sport, models usually suffer a bit of a drag penalty because they're outfitted with body moldings that give them the look of a race or sports car. What they don't tell you is the look usually outweighs the actual effectiveness of the body changes."

### GENERATION SIX

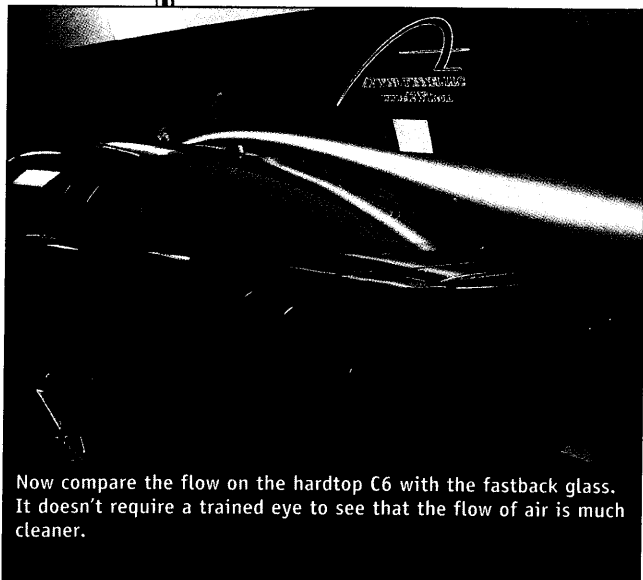
At last, we've made it to the present in our little field trip through Corvette

### KNOW YOUR CODES

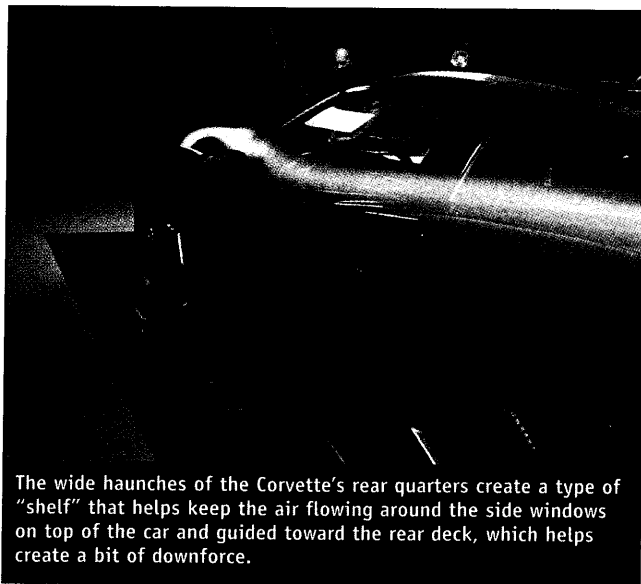
In the chart, we listed both CD and CDA, and unless you're a professional aerodynamicist or just really good at Jeopardy-type trivia, the difference is probably a bit confusing. CD stands for "coefficient of drag" and is a measurement of how much drag a particular shape produces regardless of size. CDA stands for "coefficient of drag area," and is simply the CD multiplied by the frontal area of the vehicle. Theoretically, a C6 Corvette and a Matchbox-sized scale replica should have the same CD. CDA is a better real-world number because size does come into play when we are talking about drag in terms of how much horsepower is required to reach 100 mph. So even though one car may have a slightly worse CD than another, it can actually be more aerodynamically efficient if it's smaller and has a better CDA. \*



Notice how the headlamps on this convertible C6 cause no disruption at all to airflow. Also, one of the big aero advantages with modern automobiles is flush-mounted glass, which provides no harsh transitions to create turbulence in the air.



Now compare the flow on the hardtop C6 with the fastback glass. It doesn't require a trained eye to see that the flow of air is much cleaner.

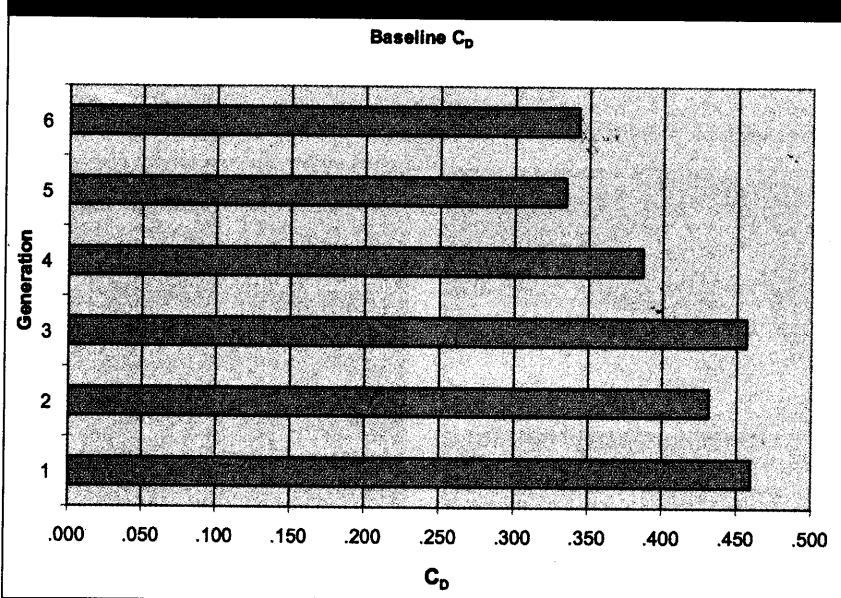


The wide haunches of the Corvette's rear quarters create a type of "shelf" that helps keep the air flowing around the side windows on top of the car and guided toward the rear deck, which helps create a bit of downforce.

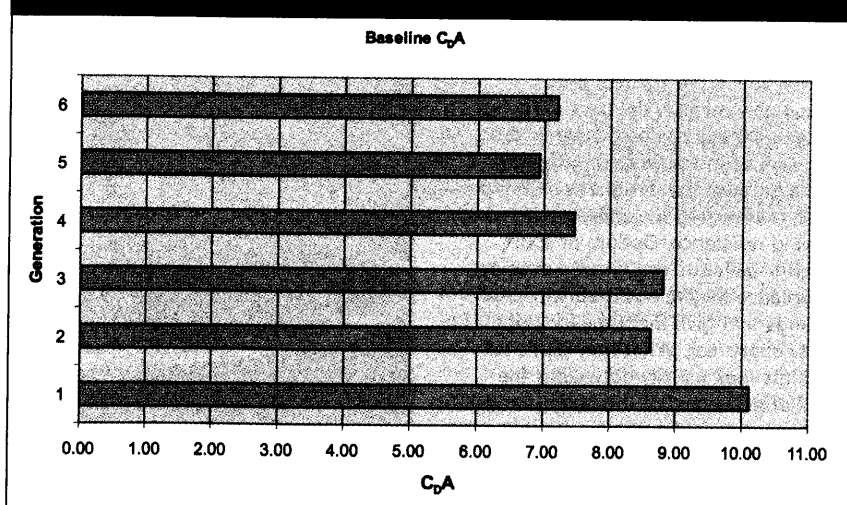
history. Eaker says of the C6, "Here, we're getting to a car with much fewer compromises. In the '60s, the main design criteria was simply to make a car that was fun. In the '70s, they added all the social responsibility that we talked about earlier, and the fun factor really suffered. In the '80s, the technology began catching up, and now we've finally gotten to a stage where the car can be socially responsible with good safety features and respectable gas mileage, and also more fun than any of its predecessors."

The C6 is also the first Corvette since the C1 not to have hide-away headlamps. That cut down on our number of tests, but we made up for it by throwing in two cars once again. This time we decided to test a convertible (also owned by John Walton) against a hardtop (owned by Jimmy Kontoulas). As you might expect, the ragtop fared worse in the comparison. CDA for the convertible came in at 7.41 with passengers, compared to the hardtop's 6.99, but it still did better than the C5's 7.70 with the headlights up. The most interesting part of the comparison came when we compared the lift numbers. Although slight, the convertible actually turned in lower lift numbers. When comparing the hardtop C5 to the hardtop C6, the C5 actually has better drag numbers until you put the headlamps up, and then the C6—with its clear lens covers—wins. It turns out that the C6's "homage" to the original Corvette not only looks good but adds performance, too. **CF**

COEFFICIENT OF DRAG BASELINES



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