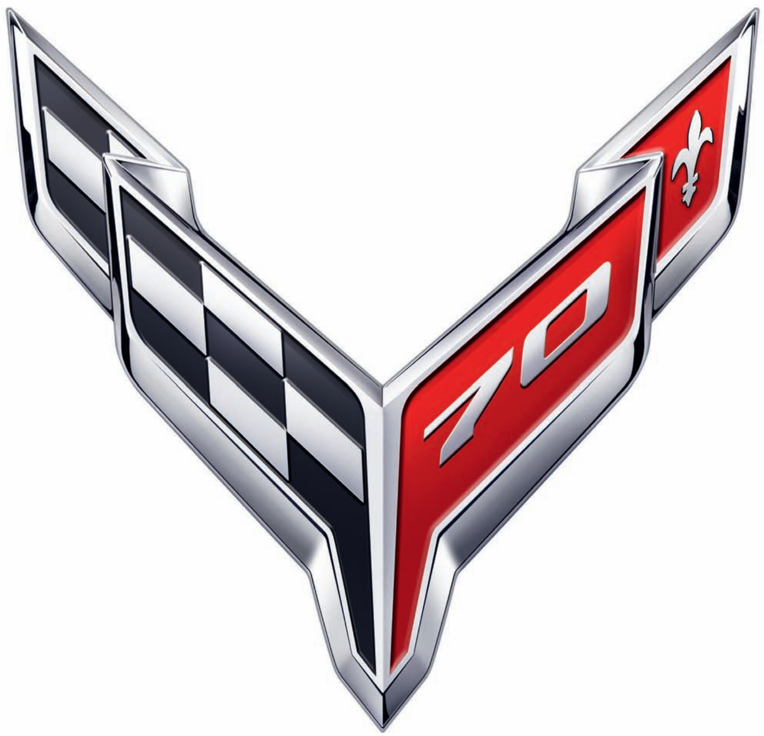
CORVETTE

70 YEARS | THE ONE AND ONLY

RICHARD PRINCE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CORVETTE

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motorbooks

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INTRODUCTION

DEDICATION

This book is dedicated to my wife Carolyn and son Michael, whose love and support for me mean everything, and to my sister Jamie, who initiated my Corvette journey many years ago.

In the post–World War II era General Motors was not just the largest car company in America, it was the mightiest industrial concern on earth. In one way or another, GM touched virtually all aspects of modern life, making everything from tanks and locomotives to home appliances, earth-moving equipment, and airplanes. But of course, above all else it made cars and trucks, and Chevrolet, its largest division, made more of them than anyone else, producing approximately 13.4 million during the 1950s. So why would a company that made practical and economical transportation by the millions, for the masses, get involved with a ridiculously low-volume, relatively expensive, difficult-to-assemble sports car?

The answer is surprisingly simple. GM created Corvette because people with the vision, the passion, and the power to do so wanted to. People like Harley Earl, Ed Cole, Maurice Olley, Clare MacKichan, Carl Renner, Duane Bohnstedt, Joe Schemansky, Jim Premo, Walt Zetye, Vincent Kaptur Sr., Tony Balthasar, Bill Bloch, Bob McLean, and Thomas Keating, among others. Over the ensuing decades a great many more men and women with equal passion and commitment nurtured the magical creation these pioneers gave birth to, pulling it back from the brink of extinction more than once, and making it better in every measure each step of the way. That continues to this day, with designers, engineers, technicians, assemblers, marketers, managers, and executive leadership who not only believe in the value that Corvette delivers to GM, but actually love the car for its own sake, and take tremendous pride in their association with it.

Corvette has come a long way over the past seven decades. In the 1950s it went from an anemic anomaly in GM's vast arsenal to a viable product in the marketplace and a force to be reckoned with in production-class racing. In the 1960s it won the muscle car war and raised the styling bar to a level none could approach. Throughout the 1970s it continued moving the ball up the field while surviving strangling government emissions and safety regulations. Regaining its performance footing in the 1980s and 1990s, it fought off fierce competition from Germany, Japan, England, Italy, and elsewhere. Over the past two decades, on the street and on racetracks near and far, it has matured into a true supercar in every measure, but without the supercar price. For seventy years Corvette has outstyled, outengineered, outperformed, and outlasted every opponent.

In the process, Corvette has accomplished something truly remarkable. It has so thoroughly permeated our collective consciousness and become such an integral part of the lives of so many people that, in a sense, it has transcended the status of a mere machine, evolving instead into a living, breathing organism, and, for millions, a member of their family. From the Pacific Coast Highway to the Manhattan skyline, from the Canadian Rockies to the Gulf of Mexico, from the tortuous airport course in Sebring, Florida, to the Bonneville Salt Flats, from Saturday night drag racing in small towns across this great land of ours to overall victory on the high banks of Daytona International Speedway, and from Main Street, USA, to the medieval city of Le Mans, Corvette is recognized, respected, and loved for exactly what it is: an American cultural icon, the flagship of General Motors, and, quite simply, the best production sports car in the world.


Spirit of SEBRING '76
GOODYEAR
BOSCH
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CHEVROLET
CORVETTE CHALLENGE
Goodwrench Service Plus
Goodwrench
CORVETTE
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CHEVROLET

1

DREAM CAR

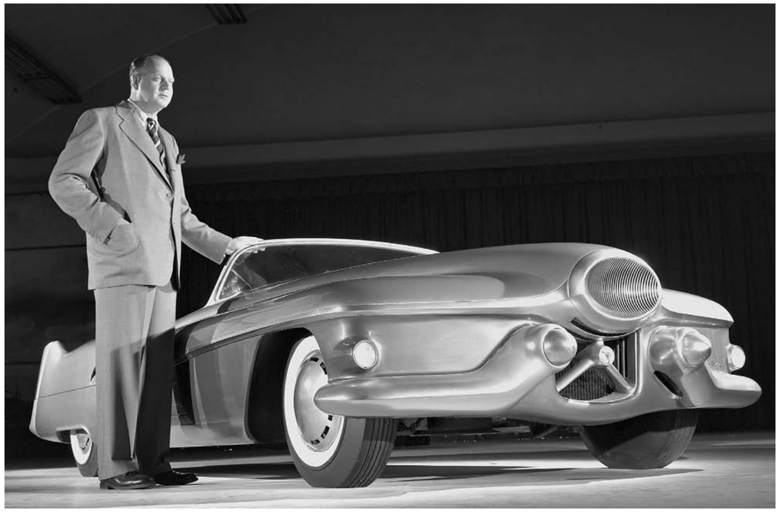
1953

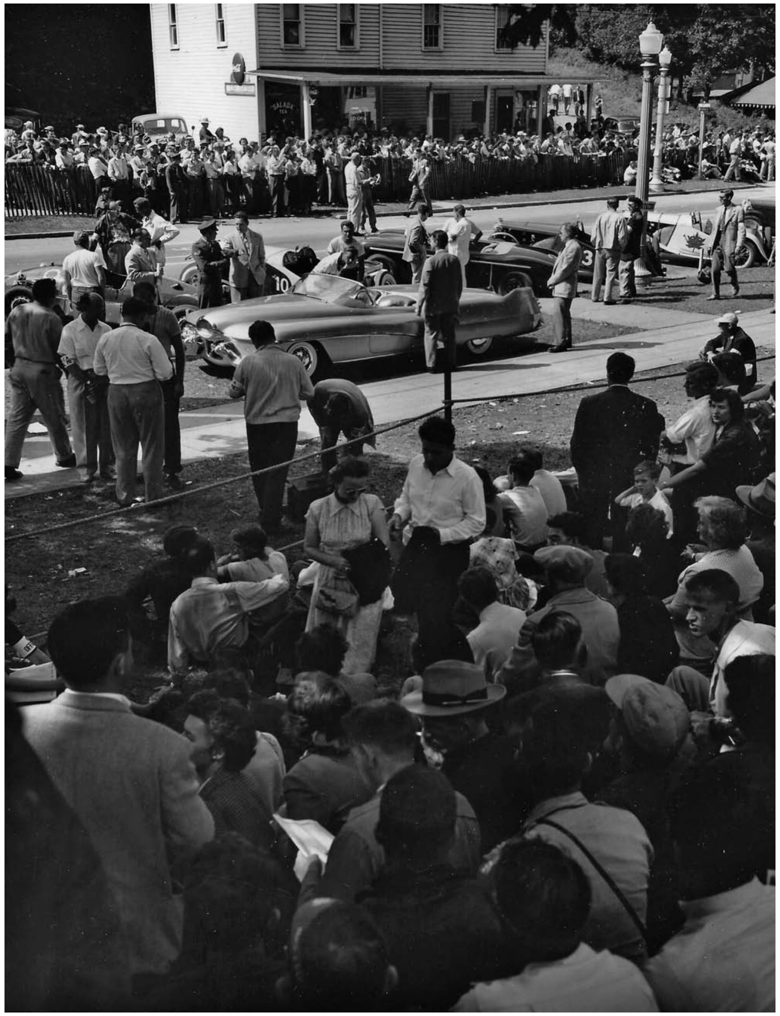
With pageantry befitting a Hollywood premiere and all the showmanship of a Broadway production, the grand ballroom doors of Manhattan's Waldorf Astoria Hotel swung open on January 17, 1953, to kick off General Motors' 1953 Motorama. The undisputed star of the show in New York—as it would be in subsequent showings in Miami, Chicago, Los Angeles, San Francisco, Dallas, Kansas City, and elsewhere—was a gleaming white sports car with a fiberglass body. It was called Corvette.

◀ The GM Motorama opened to the public on January 17, 1953, in New York's Waldorf Astoria, with some 55,000 people in attendance on that day. Chevrolet's new sports car was clearly the star of the show.

▶ Harley Earl served as head of GM's Art and Colour Section from its founding in 1927 through his retirement in 1958. The most influential automotive designer in history, Earl is rightfully called the father of the Corvette.

▼ It was while pacing the 1951 Watkins Glen street race in his *LeSabre* dream car, seen here prior to the race's start, that Harley Earl decided that GM should build a sports car.





Chevrolet's sporty two-seater was the brainchild of Harley J. Earl, the single most influential designer in automotive history. Earl, who had a background in engineering and in design, led what was initially called General Motors Art and Colour Section from its founding in 1927 until his retirement in 1958. He essentially invented the concept of styling mass-produced automobiles, and he developed processes for interior and exterior styling that are still in use today.

The idea for Corvette came to Earl in September 1951, when he brought his *LeSabre* dream car to Watkins Glen, then a hub for sports car racing in the United States. While at the track, as a guest of the Fraboni family, owners of Glen Chevrolet, Earl got up close and personal with the best European sports and racing cars of the era, and as explained in a 1954 interview with journalist Stanley Brams, that experience gave him the idea to create a small, affordably priced sporty car for GM. "Corvette is a little thing that I started," Earl explained. "I ran that *LeSabre* up pacing a race, a sport car race at Watkins Glen. That's where I got the idea for the Corvette."

In early 1952 a small group of stylists, led by designer Henry Lauve, who was head of GM's color and interior studios, was hand-picked by Earl to create a GM sports car, which they called *Project Opel*. This group, which in addition to Lauve included exterior designers Carl Renner and Duane Bohnstedt, and interior designer Joe Schemansky, gathered in secrecy in a small studio on the ninth floor of the General Motors Research Laboratory, a handsome art deco structure designed by Albert Kahn and built on West Milwaukee Avenue, directly across the street from the imposing GM headquarters.

Over time, the *Project Opel* team grew to include more expert designers and craftsmen: Vincent Kaptur Sr., in charge of body engineering at GM Styling; skilled draftsman Carl Peebles; stylists Clare MacKichan and Bill Bloch; and clay modeler Tony Balthasar. Earl also brought Maurice Olley and Robert F. "Bob" McLean into the fold.

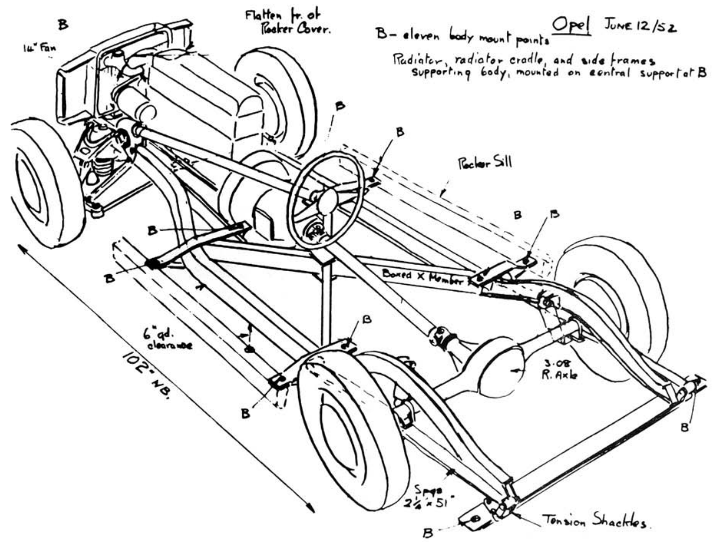
Olley, who was then head of Chevrolet's Research and Development Department, was a brilliant and innovative engineer, and a pioneer in the field of vehicle ride and handling dynamics. He began his career with Rolls-Royce in 1912 and joined Cadillac in 1930. By 1952 he had amassed forty years of diverse experience in engineering, design, and manufacturing, all of which he put to work in the basic design for Corvette's chassis.

McLean was a passionate sports car enthusiast with design and engineering degrees from Cal Tech. His job was to work out the details of the new car's dimensions and layout.

Convention dictated that car designs begin with the firewall, then move forward and rearward to locate the engine, driveline, suspension. and other critical parts. Defying that convention, McLean began at the rear and moved forward from the rear axle's centerline. By the time he and Olley were finished, *Opel*'s basic dimensions had been established: the vehicle would have a 102-inch (259-centimeter) wheelbase and would be wide and low, with an overall width of 70 inches (177.8 centimeters) and a height of only 33 inches (88.8 centimeters).

In keeping with Earl's vision for the body, which was likely influenced by the Giovanni Savonuzzi-designed and Pinin Farina-built Cisitalia 202, Touring-bodied Ferrari 166 MM, Cunningham C-1, and certain other sports cars of the era, Opel would have fully integrated fenders, an unadorned beltline, and a large oval grille. It's exceptionally wide track of 57 inches front and 59 inches rear, recessed headlamps, wraparound windshield, rounded contours, and rocket-themed tail lamps gave the car a familiar and classically beautiful, but thoroughly modern and even slightly aggressive appearance.

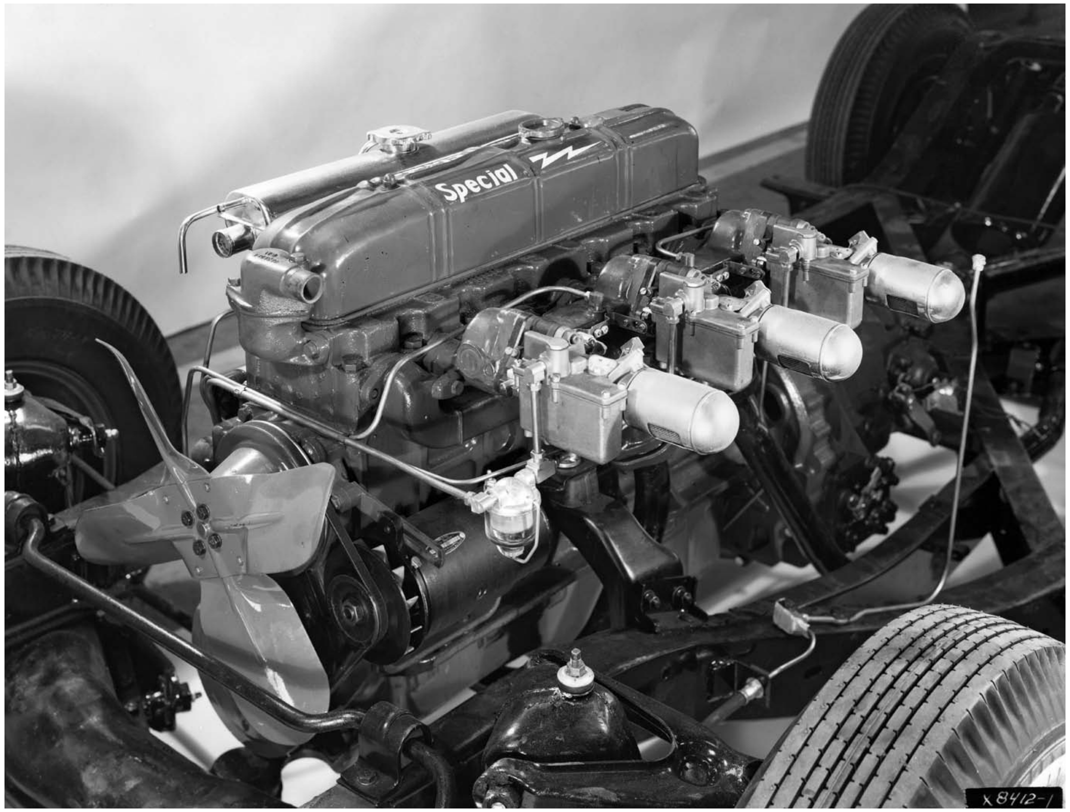
Opel's interior was handsome but relatively rudimentary, and far from ergonomic by later standards. A fiberglass dashboard was painted white on its face and red on top to minimize reflections in the windshield. Red carpet covered the floor and matching red vinyl trim adorned the door panels, dash edge, and seats. A full array of gauges kept the driver informed, and a signal-seeking AM radio was flanked by control knobs for the windshield defroster, heater fan motor, and cigarette lighter.



◀ Maurice Olley was an engineering genius and leading figure in the study and advancement of ride and handling dynamics. His June 12, 1952, sketch established the basic configuration and dimensions of the 1953 Corvette's chassis.

The chassis was similar in design to other GM cars of the era but modified considerably to compensate for the absence of a structurally rigid steel body. The side rails were fully boxed and joined together by heavy-gauge I beams in the shape of an X. A massive front crossmember and fully boxed rear crossmember completed the chassis' basic structure and helped give it sufficient torsional stiffness. Most of the front and rear suspension parts were sourced from Chevrolet's passenger car line, with numerous changes and additions, such as a large front stabilizer bar to reduce roll. Similarly, brakes and steering came from the passenger car parts bins, with a few tweaks that included a third-arm central bearing adaptor for the steering linkage. Chevrolet Research and Development engineer Walter "Walt" Zetye took the lead in designing all of the changes needed to adapt the suspension and steering to *Opel*'s unique characteristics.

Propulsion came from Chevrolet's venerable inline six-cylinder engine coupled to a two-speed Powerglide automatic transmission. An open U-jointed driveshaft brought the engine's twist from the transmission back to a Hotchkiss drive axle, which was anchored to the chassis with two longitudinal leaf springs and hydraulic shock absorbers.



▲ Chevrolet's inline six-cylinder engine was modified for use in Corvette with a high-compression cylinder head, more aggressive camshaft, dual exhaust, revised exhaust and intake manifolds, and three Carter YF side-draft carburetors, which together raised output from 115 horsepower to 150 horsepower.

Under the leadership of Harry Barr, the engine was substantially modified for use in Corvette. Barr, who was then assistant chief engineer at Chevrolet, transformed the mundane inline six with a high-compression cylinder head, more aggressive camshaft, triple Carter YF side-draft carburetors, and dual exhaust. These changes boosted output from 115 horsepower to 150 horsepower, giving the low-slung sports car very respectable performance for the period. Likewise, the standard Chevrolet Powerglide automatic was modified with heavier clutches, revised shift points, and a shorter tail housing to accommodate Corvette's shorter wheelbase.

To fit Chevrolet's relatively tall six-cylinder under the unusually low hood and help get closer to the desired fifty-fifty weight distribution, Olley moved the engine back and down as far as possible. In addition to using Carter side-draft carburetors, he specified a reshaped valve cover and new water pump casting that were specially engineered for Corvette to get the required hood clearance.

In April 1952, under the leadership of Tony Balthasar, a full-size clay model of *Opel* was completed. Technicians used this to create a completely trimmed and painted wood and plaster model for showing to GM's upper management. The car was formally unveiled in GM Styling's auditorium to an all-powerful group of men that included GM President Harlow "Red" Curtice, Chevrolet General Manager Thomas H. Keating, and Chevrolet Chief Engineer Edward N. Cole. Keating and Cole already fully supported the car and had worked hard with Earl behind the scenes to make sure it would go into production. Though he liked what he saw and gave his approval to transform the design into a functional dream car for the following year's Motorama, Curtice was not yet ready to approve *Opel* for production. He reportedly wanted to wait to gauge the public's interest as 1953's Motorama toured the country, vowing to make his decision based on how it performed.

The prevailing story that's been repeated countless times is that tremendous public reaction to the Motorama Corvette is in fact what convinced GM to quickly put this concept car into production, but that is not accurate. It's not a coincidence that Maurice Olley and Bob McLean were the primary individuals tasked with transforming Earl's ideas into a finished product. Together, they had the experience, skills, and dedication to take Project Opel from loose concept to a fully saleable automobile, which is what Earl, Cole, and Keating intended early on. And before the first Corvette was even completed, plans for production were well underway. So despite the hesitancy of Curtice and some others at GM, Project Opel was designed, engineered, and constructed from the beginning to be completely feasible for production, which is certainly not the case for nearly all of GM's other dream cars of the era.

Prototype #1

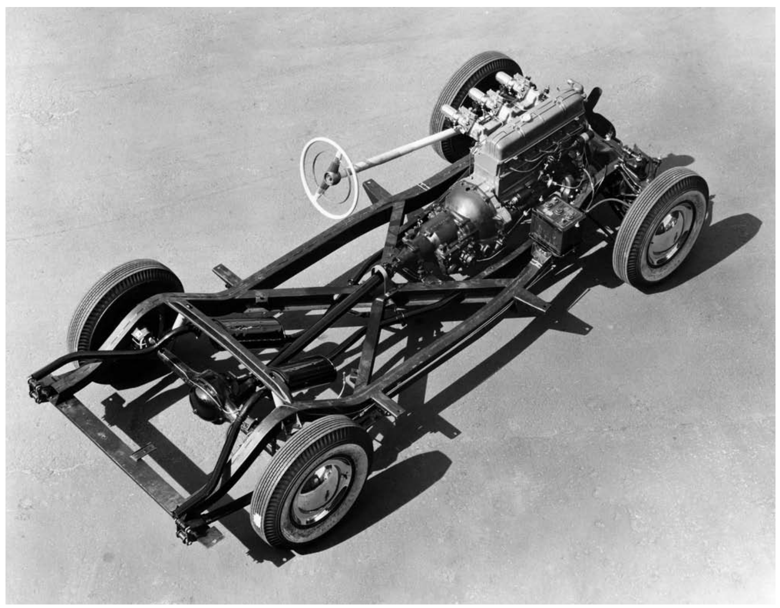
The first *Experimental Opel Car* completed was designated Chevrolet Engineering car #852. Construction was initiated pursuant to a Chevrolet Engineering work order dated July 3, 1952. This was the direct result of design work completed in June 1952 by a team of stylists, designers, and engineers Earl had assembled and put under the supervision of Maurice Olley.

The body components for #852 were designed by GM Styling and Chevrolet Engineering, then manufactured and assembled by Product Study Parts Fabrication (Parts Fab), GM's in-house protype facility. Parts Fab also created the exterior trim and radiator grille. GM Styling was responsible for the top assembly, interior trim, and body painting. The chassis was constructed by the Chevrolet Experimental Department and assembled by Chevrolet Research & Development in its 440 Burroughs Avenue facility in Detroit. Parts Fab completed the final assembly of the car, which was assigned the serial number EX-52.

Engineering car #852/EX-52 was initially scheduled for completion in early October 1952, but the actual finish date was December 22, 1952. This was the first of three preproduction *Project Opel* cars assembled, and it was destined to be the 1953 GM Motorama show car. But it needed a name.

The press unveiling was slated for January 16, 1953, with the public viewing the following day at the opening of the 1953 GM Motorama in the Waldorf Astoria. All that Chevrolet's advertising agency, Campbell-Ewald, had to go on was that the new car's name was to begin with the letter "C," but none of their ideas had wowed Chevrolet leadership. Then Myron E. Scott, a 35-year veteran of the Chevrolet public relations department, suggested the name Corvette. All concerned agreed that this sounded good. Since a corvette in naval terms was a small, fast, highly maneuverable warship produced by the British during World War II, it had the right connotation for Chevrolet's new sports car.

In October 1953, after it had toured the country and been driven a total of 111 miles, Chevrolet determined that this first model—the Motorama show car initially called Chevrolet Engineering car #852, then EX-52, and finally Corvette—would meet an unceremonious end. The body was stripped of nearly all its trim, wiring, instrumentation, and other components and, though everything was initially slated to be "retained for future use," all the parts except the soft top assembly were removed and reportedly scrapped in November 1953. The soft top assembly was sent to a Mr. Richey at GM Styling.



▲ Technicians in Chevrolet Parts Fab made the fiberglass panels by hand for the very first Corvette prototype and then assembled them into a complete body.

◀ This preproduction chassis is believed to be for Chevrolet Engineering car #856, the second Corvette prototype built, which was used for extensive testing in 1953 and 1954.

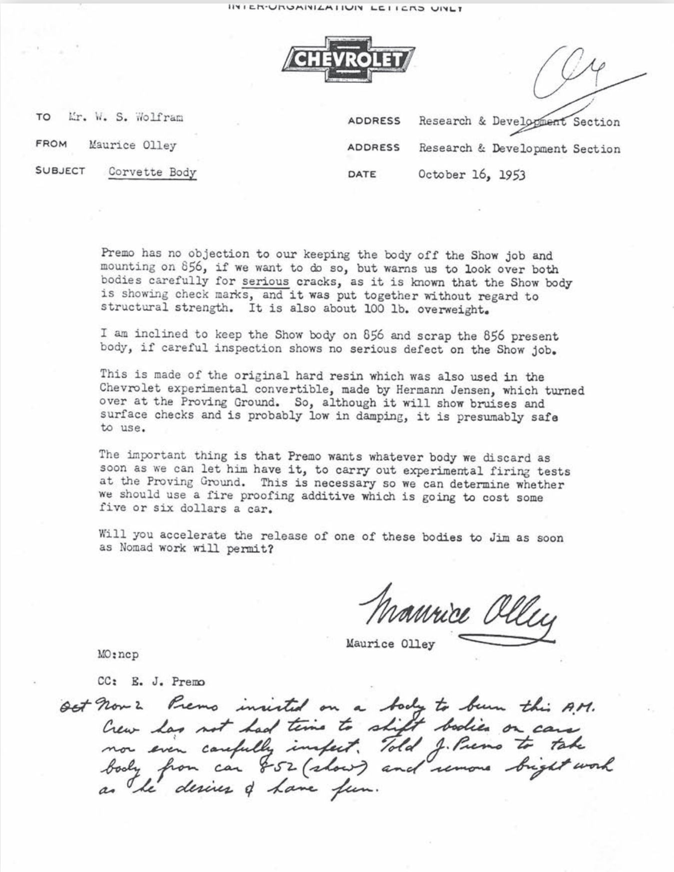
▶ After opening in New York, the 1953 GM Motorama went to several major cities across the country, including Miami, Chicago, and Los Angeles. By the time it reached San Francisco at the end of April, more than a million people had seen the new Corvette.

Ellis James "Jim" Premo, Chevrolet assistant chief engineer, requested the body from #852 for "experimental firing tests at the Proving Ground." Engineers wanted to determine whether the rate at which a Corvette body burned necessitated using "a fire-proofing additive which is going to cost some five or six dollars a car," according to Maurice Olley in a letter to W. S. Wolfram dated October 16, 1953. Olley had asked Premo if he had any objection to burning the body from the *second* preproduction Corvette, known by its Chevrolet Engineering designation of #856, instead of the body from #852, the Motorama show car. Car #856 had served as the primary test and development car at the Milford Proving Ground, and Olley thought it might be more sensible to burn that body and then install the lightly used body from #852 on the #856 chassis for further development work. Premo didn't care which body was sent to Milford to be burned, so Olley asked for both to be inspected. It was thought that the second body might be preferable for further development, even though it had already undergone a lot of harsh testing, because it featured some structural reinforcements that were absent in the Motorama show car.

Unfortunately, the engineers didn't find the time to inspect either body, likely because they were busy getting the Corvette-based *1954 Motorama Nomad Station Wagon* show car finished in time for the 1954 GM Motorama. On November 2, 1953, as told in a handwritten addition to Olley's October letter about releasing one of the bodies to Premo, "Premo insisted on a body to burn this A.M. Crew has not had time to shift bodies on cars nor even carefully inspect. Told J. Premo to take body from car 852 (show) and remove bright work as he desires & have fun."

Accordingly, on Monday, November 2, 1953, the body from #852, the first Corvette ever made, was shipped to the Milford Proving Ground, to the attention of Mr. C. Caswell, and on Friday, November 6, 1953, it was intentionally destroyed by fire in a test to measure the flammability of its fiberglass panels.

A Chevrolet Engineering work order dated October 8, 1953, authorized the chassis from #852 to be rebuilt and modified as needed for the construction of the *1954 Motorama Nomad Station Wagon*, which was assigned engineering #857. This car was reportedly scrapped in 1959.


INTER-ORGANIZATION LETTERS ONLY

CHEVROLET

Ol

TO Mr. W. S. Wolfram
FROM Maurice Olley
SUBJECT Corvette Body
ADDRESS Research & Development Section
ADDRESS Research & Development Section
DATE October 16, 1953

Premo has no objection to our keeping the body off the Show job and mounting on 856, if we want to do so, but warns us to look over both bodies carefully for serious cracks, as it is known that the Show body is showing check marks, and it was put together without regard to structural strength. It is also about 100 lb. overweight.

I am inclined to keep the Show body on 856 and scrap the 856 present body, if careful inspection shows no serious defect on the Show job.

This is made of the original hard resin which was also used in the Chevrolet experimental convertible, made by Hermann Jensen, which turned over at the Proving Ground. So, although it will show bruises and surface checks and is probably low in damping, it is presumably safe to use.

The important thing is that Premo wants whatever body we discard as soon as we can let him have it, to carry out experimental firing tests at the Proving Ground. This is necessary so we can determine whether we should use a fire proofing additive which is going to cost some five or six dollars a car.

Will you accelerate the release of one of these bodies to Jim as soon as Nomad work will permit?

Maurice Olley
Maurice Olley

MO:ncp

CC: E. J. Premo

Oct Nov 2 Premo insisted on a body to burn this A.M. Crew has not had time to shift bodies on cars nor even carefully inspect. Told J. Premo to take body from car 852 (show) and remove bright work as he desires & have fun.

◀ The people who created Corvette understood they were working on a special car, but in the context of the time it was just one among many "dream cars" for which they were responsible. This helps explain why nobody involved thought it important to preserve the first prototype, the Motorama show car, and thus its body was destroyed in a November 6, 1953, flammability test.

Production Begins

In order to get 1953 Corvettes into customer's hands as quickly as possible, a temporary six-car-long assembly line was set up in a small customer delivery building on Van Slyke Avenue in Flint, Michigan. Though Chevrolet announced that the first production Corvette was completed June 30, 1953, consistent with Chevrolet General Manager Thomas Keating's proclamation at the January 16, 1953 pre-Motorama press event that Corvette would be in production by the end of June, it is believed that the first car completed in Flint was actually final-assembled on July 7, 1953. By the end of December the last of approximately three hundred 1953 Corvettes was assembled. Each of the hand-built, fiberglass-bodied cars was Polo White outside and Sportsman Red inside. Though technically called options, all were equipped with a radio and heater, which brought their list price to $3,734.55.

The most innovative aspect of the whole car was its fiberglass body. Manmade plastics were certainly not new in 1953, with nitrocellulose, the first completely synthesized example, dating back to 1856. The science of plastics was still relatively young, though, and its use in the mass production of automobile bodies had not yet been attempted. World War II had accelerated advances in plastics manufacturing, and various companies, including Chevrolet, had been working on plastic body panels since the war ended. Resin manufacturer Naugatuck Chemical, a division of United States Rubber Corporation, was a leading advocate for use of the new material in the auto industry, and its representatives did a good job of convincing Cole, Olley, and others at GM that the technology was advanced enough for use in Corvette.

In fact, without the benefits of low tooling costs and shorter tooling time that fiberglass-reinforced plastic body panels offered, Corvette would not have gone into production in 1953 and may not have gone into production at all. The nascent technology still posed risks, however, as the design team quickly learned.

SELLING CHEVROLET'S SPORTS CAR

With no experience in marketing low-volume sports cars, Chevrolet's salespeople hatched the idea of selling as many of the three hundred 1953 units as they could to high-profile individuals, hoping their embrace of the car would serve as an endorsement that would inspire others to buy when production ramped up in 1954. The first three production cars were retained by Chevrolet for testing and development and the next three were sold to executives at DuPont de Nemours, Inc., not surprising given that company patriarch Pierre S. du Pont had invested in GM beginning in 1914, became a director in 1915, and saved the company from financial collapse in 1920. In 1953 du Pont family members were, by a considerable margin, the largest shareholders in GM.

Serial number E53F001004, the fourth production Corvette built and the first one sold, went to Down Motor Company in Morristown, New Jersey, for delivery to Mr. J. Spencer Weed, a DuPont executive. E53F001005 was sold through Wilmington, Delaware, Chevrolet dealer Frank Diver, Inc. to Crawford

▲ The floor and firewall was the car's single largest panel, serving as the starting point of the body assembly line at the Flint, Michigan, plant.

▶ The bodies for 1953 Corvettes were assembled entirely by hand in a small Chevrolet customer delivery building on Van Slyke Avenue in Flint, Michigan.

Hallock Greenwalt, a chemical engineer involved with the Manhattan project who, in 1953, was president of the DuPont Company and husband to Margaretta du Pont Greenewalt. E53F001006 was delivered by Colonial Chevrolet Company of Wilmington, Delaware, to Henry Belin Du Pont, vice president of DuPont and great-great-grandson of the company's founder, Éleuthère Irénée du Pont de Nemours. Other 1953 Corvettes went to equally influential people, including entrepreneur and sportsman Briggs Cunningham, who bought E53F001011; Frank W. Fink, designer and chief engineer of the B-24 Liberator bomber, who bought E53F001028; Ralph A. L. Bogan, a founder of the Trailways and Greyhound bus companies, who bought E53F001034; Hollywood star John Wayne, who bought E53F001051; and Cyrus Rowlett Smith, CEO of American Airlines, who bought E53F001100.

The Finished Car

What was it like to actually own and drive a 1953 Corvette? Despite its less-than-stellar engine and transmission combination, the 1953 Corvette's overall performance was respectable when put in context. It would reach 60 miles per hour (96.56 kilometers per hour) from a standing start in 12.0 seconds flat and topped out at about 106 miles per hour (170.59 kilometers per hour). The most powerful domestic cars of the era, such as the Cadillac 62 and Oldsmobile's Super 88, could out-accelerate Corvette—but none could better its handling and braking performance, owing primarily to the two-seater's substantial weight advantage.

How the early Corvette fared against foreign sports cars wasn't a concern for GM's marketing department, but it's interesting to consider the car's potential when placed alongside the international competition. Better-known examples like the Jaguar's XK120 and Mercedes' 300 SL ran higher top speeds and easily out-accelerated and out-braked Corvette. When it came to handling, though, GM's offering could match these expensive semiexotics.

This according to no less an authority than Dr. Dick Thompson, "The Flying Dentist", who in the 1950s won multiple Sports Car Club of America (SCCA) national championships, driving Jaguars, Porsches, and Austin-Healeys in addition to Corvettes.

street, desiring instead an easygoing grand touring machine with a sporty flair. This conception was aptly summed up in a statement from Chevrolet General Manager Thomas Keating, in a preface to the 1953 Corvette press release.

> **In the Corvette we have built a sports car in the American tradition. It is not a racing car in the accepted sense that a European sports car is a race car. It is intended rather to satisfy the American public's conception of beauty, comfort, and convenience, plus performance. Just as the American production sedan has become the criterion of luxury throughout the world, we have produced a superior sports car. We have not been forced to compromise with the driving and economic considerations that influence so broadly European automotive design.**

◀ All 1953 Corvettes got a primer coat that was wet-sanded prior to painting.

▼ As revealed in this June 1953 advertisement, Corvette shared the spotlight with four other "Dream Cars" at the 1953 Motorama. It's interesting to note that in addition to Corvette, the *Buick Wildcat*, *Oldsmobile Starfire*, and *Cadillac Le Mans* all had fiberglass bodies.

While racing his Porsche Super at Andrews Field outside of Washington, D.C., Thompson had the opportunity to drive a new 1954 Corvette. Bob Rosenthal, a local Chevrolet dealer, brought the car out to the event just to demonstrate it, not to race, and he asked the reigning F-production national champion if he would take it around for a few laps.

Despite the car's limitations due to its relatively poor power-to-weight ratio and its two-speed automatic transmission, Thompson posted lap times equivalent to those of the Jaguars and other fast cars present at the event. "I was impressed with the car," Thompson recalled, "because it handled very well, comparable to my Porsche and the Jag I replaced it with."

In a harbinger of future issues, though, the Corvette's brakes were all but gone after just a few hard laps. Thompson noted, with a tinge of sarcasm, "the Powerglide didn't help me stop it very much, especially after the rear seal blew out!"

Corvette's performance limitations were not an issue for the car's creators, at least not in 1953. They concluded that Americans didn't want a competition-ready vehicle for the street, desiring instead an easygoing grand touring machine with a sporty flair.

Corvette's beauty was undeniable, a feature that Keating placed first in his list of the car's winning attributes. Performance, though modest in areas, was adequate and thus earned its position at the end of the list. But what about comfort and convenience, and the implication that somehow Chevy's "superior sports car" had benefited from American sedans' status as "the criterion of luxury throughout the world"?

Keating and anyone else who spoke of comfort, convenience, and luxury in the same breath as Corvette were off the mark. Basic luxuries such as power steering, power brakes, air-conditioning, and leather seats were still years away in 1953. Even items that could most appropriately be labeled necessities, including exterior door handles, door locks, and proper roll-up windows, were not available in that year's model.

Besides the notable absence of luxury and even necessary features, very early Corvettes were, in many respects, simply difficult to use. This fact was not lost on media wags of the day, who most often praised the car's stunning design and good performance but spared nothing in criticizing its functional shortcomings. After experiencing the difficulties involved in erecting the soft top, *Motor Trend*'s Don MacDonald wrote that Chevrolet's "conception of the Corvette market is that no owner will be caught in the rain without a spare Cadillac."

The motoring press was equally harsh when it came to the Corvette's bad weather sealing, leaky carburetors, and poor fit and finish. Defects in the body were particularly problematic, owing almost entirely to the rush to production and inexperience with fiberglass panel manufacturing and finishing at both Chevrolet and its suppliers, including Molded Fiber Glass (MFG) Companies of Ashtabula, Ohio, and Lunn Laminates (Lunn) of Huntington Station, New York.

▶ While early Corvettes were widely criticized for poor fit and finish, it's something of a miracle they looked as good as they did when we see the conditions in which they were made on the temporary assembly line set up in Flint, Michigan.

The first body panels were made using the hand–lay-up method at GM's Parts Fab facility. Starting with female molds constructed from wood or phenolic resin by Bill Weaver's Modern Pattern tool shop in Toledo, Ohio, technicians cut and laid fiberglass mat into the molds, saturated the mat with resin, and used rollers or scrapers to compress the mixture and eliminate air bubbles. These hand-laid panels were used for the preproduction prototypes and possibly some of the first fifty Corvettes assembled in Flint, Michigan. After that, most of the panels came to Flint from suppliers, pursuant to a March 3, 1953 contract Chevrolet awarded to MFG to manufacture Corvette body parts using the vacuum bag-molding process. From May 1953 through December 1, 1953 MFG subcontracted the production of panels via vacuum bag-molding to Lunn. A November 20, 1953 letter from Chevrolet awarded a contract directly to Lunn for production of Corvette body panels starting December 1, 1953.

With vacuum-bag molding, workers put fiberglass mat and resin in a female mold, placed a plastic bag around the mold, sealed it, and applied a vacuum through a valve in the bag to suck out the air. Once the vacuum was applied, atmospheric pressure compressed the fiberglass mat and resin matrix. Though this technique was better than not using a vacuum bag, it still left a lot to be desired. The panel thickness varied considerably, making it difficult to get good fitment when all the panels were assembled into a complete body. And though the vacuum eliminated almost all trapped air bubbles in the resin, it tended to create concentrations of resin in recesses and corners and along edges. The correct ratio of mat-to-resin gave the finished panels their strength and longevity, but with insufficient mat, the resin-rich areas were brittle and more likely to crack.

The problems associated with poor-quality panels only multiplied when they were assembled and painted. The 1953 Corvette body was comprised of sixty-two separate panels bonded together and the bonding seams tended to have a lot of trapped air bubbles. As with the air trapped in the panels, these expanded when the exterior primer and paint were baked and caused craters to appear.

Overall production quality, and body quality in particular, steadily improved throughout 1953 and early 1954. This was largely due to the transition from hand–lay-up to the vacuum-bag method of making panels. Around June 1954, body panel quality improved further with the transition to matched-mold manufacturing, which entailed compressing resin-saturated fiberglass mat between matched female and male molds. This yielded stronger panels with more uniform thickness. Early mold sets were made from phenolic resin, while subsequent molds were produced from machined and polished castings of Kirksite. Made of zinc alloyed with aluminum, copper, and magnesium, Kirksite is well suited to die-making because of its low melting temperature, excellent fluidity, and good surface hardness.

Going into 1954, quality control took a significant step forward with the transition to a new, dedicated assembly plant. While the first three hundred Corvettes were being hand-assembled in Flint, Michigan, a portion of Missouri's sprawling St. Louis Chevrolet Assembly Plant complex, at the intersection of Union Boulevard and Natural Bridge Avenue, was being readied as a permanent home for Corvette production. What was then known as the Fisher Mill Building, so named because it began as a mill that produced wooden body parts for the Chevrolet touring and roadster bodies that were then assembled in Flint, became the Corvette Assembly Plant. The new facility for Corvette manufacturing occupied all 266,025 square feet of the Fisher Mill Building, while the remainder of the St. Louis complex continued to assemble Chevrolet passenger cars and trucks, just as it had done since 1920.

Output increased considerably after Corvette production moved to St. Louis, and by the end of model year 1954 Chevrolet had produced 3,640 Corvettes. Though far more than the previous year's production, this total was considerably less than what the company had projected. When Chevrolet purchasing agent Elmer Gormsen called Robert Morrison, president of MFG, in March 1953 to tell him that his company had won the bid to manufacture Corvette body panels, the initial contract called for the production of 12,300 units, 300 during 1953 and another 12,000 in 1954.

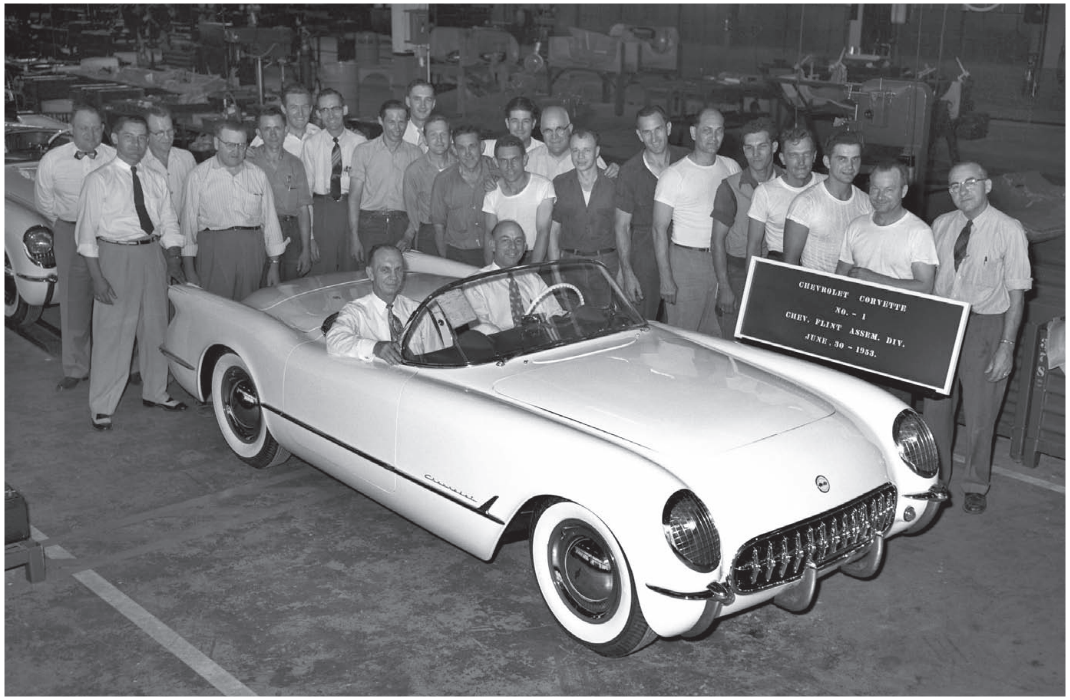
◀ An employee in Bill Weaver's Modern Pattern tool shop in Toledo, Ohio, polishes the surface of a phenolic resin mold for the 1953–1955 Corvette's upper front surround.

▲ When the design for Corvette was finished, the entire body was beautifully sculpted from mahogany, which was easy to shape and extremely stable. This mahogany master served as the pattern for production of phenolic resin molds that were used to make Corvette body panels. The phenolic resin molds were also used on Keller machines to produce matched metal dies, which yielded better quality body panels.

◀ After arriving at the Flint plant, Corvette chassis, which were manufactured for Chevrolet by A. O. Smith Corporation, received their suspension, brakes, steering, engine, and drivetrain components before being married to a fully assembled body.

▼ After the freshly painted bodies exited the spray booth and got polished, they rolled along the trim area, where wire harnesses, windshield wipers, headlight and taillight assemblies, bumpers, decorative stainless, windshields, interiors, and everything else were installed.

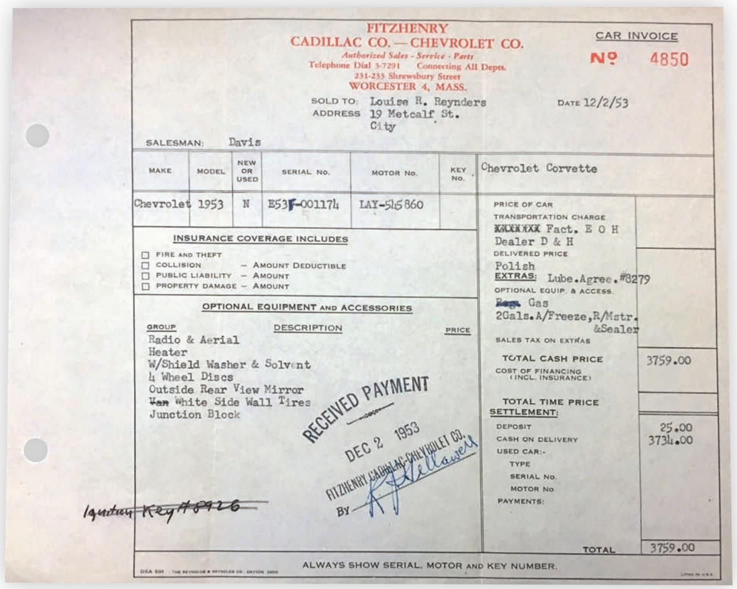
The actual total for 1954, 3,640 units, was far short of the projected 12,000, and by the fall of 1954, 1,076 of the Corvettes built sat outside at the St. Louis plant without buyers. Quality issues and a lack of creature comforts had squelched enthusiasm for the car, and Chevrolet's bold entrée into the sports car market was in danger of going extinct before it really had a chance. It would take hard work by a small group of intensely dedicated visionaries to stave off the executioner.



▲ According to a June 30, 1953 Chevrolet press release and accompanying photos, including this one, the first production Corvette rolled off the line that day, but compelling evidence suggests that these photos were staged on June 29, 1953 using three pre-production cars, including EX-52, the Motorama show car, and that in fact actual production had not yet begun. Chevrolet Engineering records indicate that E53F001003 was the first Corvette completed in the Flint plant, and its final assembly took place on July 7, 1953. This car was then driven by engineers C. Hermann Jensen and Gerhard Kuiper to the GM Tech Center for a series of tests there and at Harrison Radiator in Lockport, New York. In this photo, Flint Plant Manager F.J. Fessenden is in the passenger seat and the man standing second-from-right is foreman Anthony Kleiber. The man second-from-left is Carl Henry Jarema, an industrial engineer with GM for 41 years beginning in 1944. As a quality control specialist, he drove each of the 300 1953 Corvettes built on a four mile loop to ensure everything worked. His son, Robert Jarema, worked in purchasing and supply chain at GM for almost 40 years, and his grandson and namesake, Carl Jarema, is today a chassis systems engineer for GM Defense.

▲ Taking delivery of a new 1953 Corvette was an exciting occasion, even for the prominent people who were given the opportunity to buy one, including the Wallach family from Brewster, New York, seen here with 1953 Corvette serial number E53F001075. Today it is owned by Alan Blay. Rita Wallach, whose father was medical director for the DuPont Company, is in the driver's seat and her husband Edouard Wallach, a financial manager for the Rothschild family, has his arm around nine-year-old son Steven. The other two men are Mr. Brady and Mr. Stannard, owners of the dealership, and the little rascal is the Wallachs' three-year-old son Timothy.

▶ The present owner of E53F001174 cherishes the car's original sales invoice, showing that it was delivered new on December 2, 1953, by Fitzhenry Cadillac-Chevrolet Company to Louise R. Reynders, a University of Oregon and Smith College alumna whose husband John Reynders was an automobile draftsman in the 1920s and an executive with United States Envelope for nearly four decades.



FITZHENRY
CADILLAC CO. — CHEVROLET CO.
Authorized Sales - Service - Parts
Telephone Dial 3-7291 Connecting All Depts.
231-233 Shrewsbury Street
WORCESTER 4, MASS.

CAR INVOICE
Nº 4850

SOLD TO: Louise R. Reynders
ADDRESS 19 Metcalf St.
City
DATE 12/2/53

SALESMAN: Davis

MAKE	MODEL	NEW OR USED	SERIAL No.	MOTOR No.	KEY No.
Chevrolet	1953	N	E53F-001174	LAY-545860	

Chevrolet Corvette

INSURANCE COVERAGE INCLUDES
☐ FIRE AND THEFT
☐ COLLISION – AMOUNT DEDUCTIBLE
☐ PUBLIC LIABILITY – AMOUNT
☐ PROPERTY DAMAGE – AMOUNT

OPTIONAL EQUIPMENT AND ACCESSORIES

GROUP DESCRIPTION PRICE
Radio & Aerial
Heater
W/Shield Washer & Solvent
4 Wheel Discs
Outside Rear View Mirror
~~Van~~ White Side Wall Tires
Junction Block

RECEIVED PAYMENT
DEC 2 1953
FITZHENRY CADILLAC-CHEVROLET CO.
By

~~Ignition Key #8926~~

PRICE OF CAR	
TRANSPORTATION CHARGE ~~XXXXXXX~~ Fact. E O H Dealer D & H	
DELIVERED PRICE Polish	
EXTRAS: Lube.Agree.#8279	
OPTIONAL EQUIP. & ACCESS. ~~Reg.~~ Gas 2Gals.A/Freeze,R/Mstr. &Sealer	
SALES TAX ON EXTRAS	
TOTAL CASH PRICE	3759.00
COST OF FINANCING (INCL. INSURANCE)	
TOTAL TIME PRICE	
SETTLEMENT:	
DEPOSIT	25.00
CASH ON DELIVERY	3734.00
USED CAR:-	
TYPE	
SERIAL No.	
MOTOR No.	
PAYMENTS:	
TOTAL	3759.00

ALWAYS SHOW SERIAL, MOTOR AND KEY NUMBER.

DSA 501

2

FROM DESPERATION

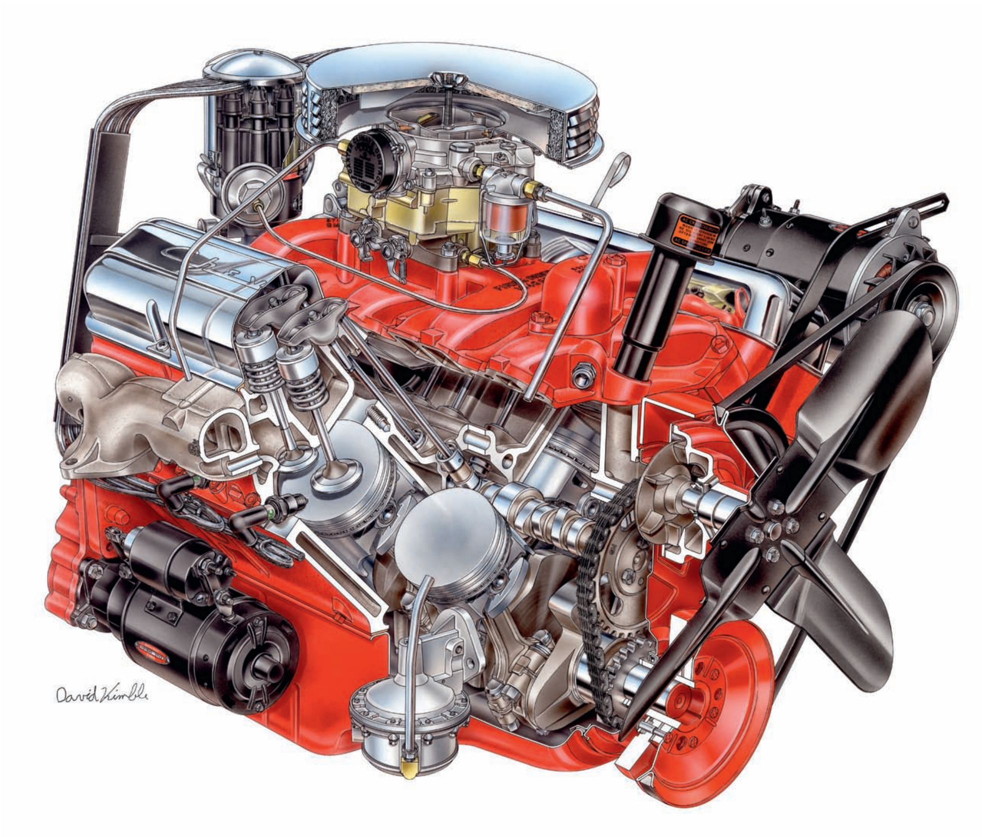
TO HOPE

Nearly one-third of the 3,640 1954 Corvettes produced remained unsold at the beginning of 1955. Chevrolet's inexperience in marketing a low-volume sports car, as well as Corvette's numerous shortcomings, had contributed to consumer apathy, and many within the ranks of upper management at GM saw no reason to continue pouring money, time, and other resources into an obvious loser. At the same time, a handful of dedicated men at Chevrolet recognized Corvette's potential and refused to let it die an unceremonious death. This group, including brilliant engineers Ed Cole and Zora Duntov, and legendary designer Harley Earl, realized that Corvette's salvation lay with dramatically improved performance and a more focused marketing strategy.

◀ Continuous improvement in panel quality emboldened Chevrolet to offer 1954s in at least three colors besides white, including Pennant Blue, Sportsman Red, and Black.

▶ All 1953 Corvettes were produced with black convertible tops and all 1954s, including this remarkably original Sportsman Red example, came with beige tops.

▼ In the decades that followed its 1955 introduction, more than one hundred million Chevrolet small-block engines have been built. A distant relative of the original 265-cubic-inch V-8 that helped save Corvette from extinction still powers today's Corvettes.



Though an improved marketing strategy would not take full flight until the next year, 1955 saw an important leap forward in Corvette's performance. This came by way of Chevrolet's revolutionary V-8. Not only was this engine relatively light in weight compared with other production engines, but it was also inexpensive to produce, reliable, high revving, and impressively powerful. Whether coupled with a two-speed Powerglide or a three-speed manual transmission (which became available for Corvette very late in the model year), the Chevrolet V-8 turned an otherwise unimpressive two-seater into a credible if not outstanding performer. And perhaps most important, at least in the short term, it put Corvette on equal footing with its newest competitor in the marketplace, Ford's aggressively styled and V-8–powered Thunderbird.

Soon after being promoted to chief engineer at Chevrolet in 1952, Ed Cole began designing a new V-8 engine for that division. Along with Harry Barr and Chris Bouvy, Cole was heavily involved with the design of Cadillac's OHV V-8, which had been introduced in 1949. Cole's predecessor at Chevrolet, Ed Kelley, led a team that had designed what was essentially a scaled-down version of the Cadillac engine for

◀ Nearly all of the seven hundred 1955 Corvettes produced were powered by the new 265-cubic-inch, 195-horsepower V-8, and cars so equipped got a large gold V in the Chevrolet fender script.

▲ After becoming chief engineer for Chevrolet in 1952, Edward Cole led the development of the company's all-new small-block V-8, which played a strong role in saving Corvette.

use in Chevrolets. Ironically, Cole set their work aside and began with a clean sheet of paper. An engineering prodigy who would ultimately ascend to the presidency of GM, he expected nothing short of a miracle when he envisioned an engine that would be smaller, lighter, higher revving, freer breathing, more powerful, and less costly to manufacture than the Cadillac V-8.

A handpicked team of GM's best engineers and draftsmen, including Don McPherson, Loren "Bob" Papenguth, and Jack Golding, worked under the watchful eyes of Al Kolbe and Cole in a research and development building on St. Aubin Street in Detroit. McPherson's cylinder head design, featuring wedge-shaped combustion chambers and integral valve guides, was efficient and effective. Interestingly, the new combustion chamber design was based largely on research done by Elliot Marantette "Pete" Estes, an engineer who, like Cole, rose to the position of Chevrolet division general manager and also became president of GM in due time. The new heads, interchangeable from side to side, were produced by a precise die-casting method that allowed for lighter, thinner-wall castings.

▲ The basic layout of the 1953–1957 interior remained the same, but details, such as the addition of CONELRAD dots to the radio face at 640KC and 1240KC during model year 1954, changed from one year to the next.

▲ Sandwiching the fiberglass-and-resin matrix between matching male and female molds, as shown here, produced smoother, stronger, more consistent parts compared with the hand-lay-up method used previously.

Stamped-steel ball rocker arms, invented by Pontiac engineer Clayton Leach for that division's OHV V-8, were specified for the new Chevy heads. These innovative rockers replaced the widely used lineup of rockers pivoting on a common shaft; they were lighter, stronger, lower in friction, self-aligning, and less expensive to manufacture. All of these attributes were also found in the valvetrain's hollow, oil-carrying steel pushrods and retention/adjustment locknut for the rocker's pivot ball.

As with the cylinder heads, Chevrolet's V-8 cylinder case benefited considerably from a new casting method, which used fewer cores that were more secure, and thus less prone to shifting. The resultant blocks had thinner walls to make this new V-8 a full 41 pounds (18.59 kilograms) lighter than Chevy's inline six-cylinder engine.

When introduced in 1955, the 265-cubic-inch (4,342.6cc) displacement Chevrolet V-8 was an immediate sensation. Just as Cole had envisioned, it was reliable, inexpensive to manufacture, and extremely powerful relative to its light weight. As a result, it revolutionized the automobile industry. Direct descendants of this engine have powered more than one hundred million production vehicles, and its progeny continue to deliver incredible performance to the present day. The small-block Chevy V-8 also gave rise to an entire aftermarket industry and has been a favorite with hot rodders, customizers, boat builders, and dreamers since the day it was born. It has also been the engine of choice for competition, with race variants thoroughly dominating motorsports around the world for decades.

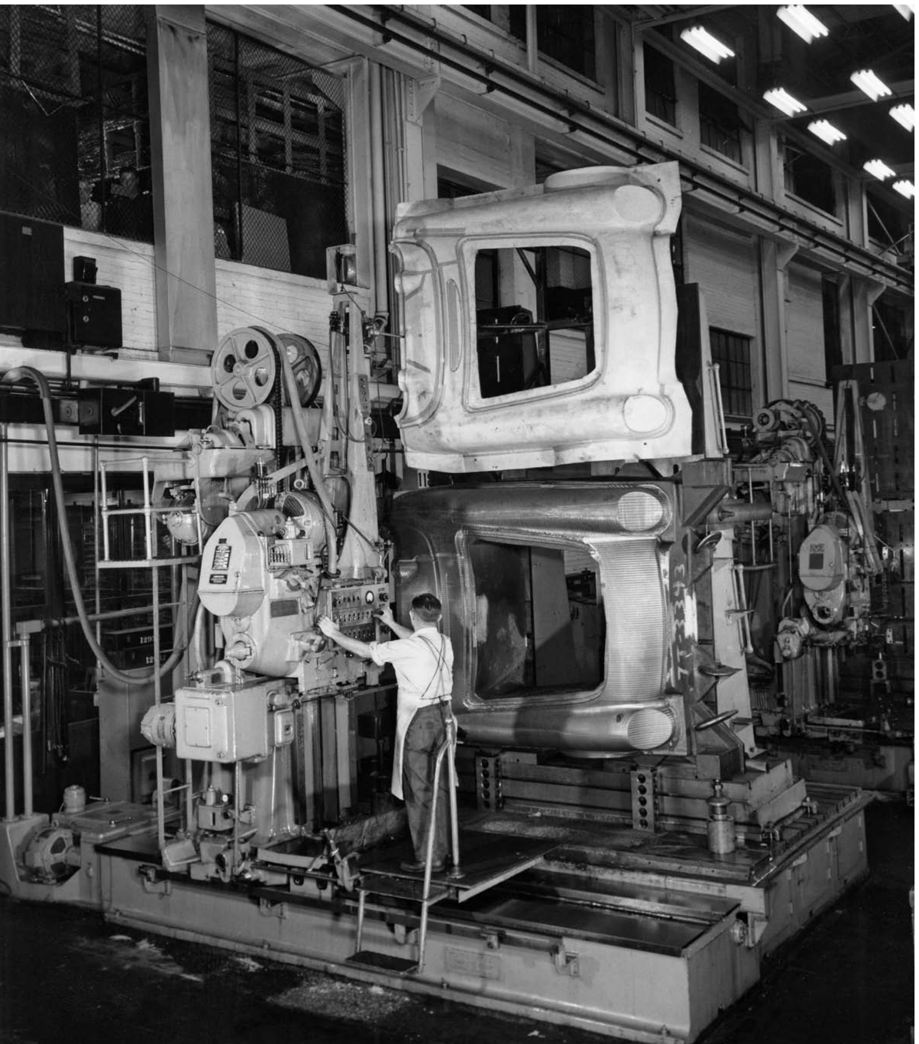
Almost all of the seven hundred 1955 Corvettes built left the St. Louis assembly plant with V-8 engines, but a small number of six-cylinder cars were produced. While Corvette's V-8 was nearly identical to the engine that revolutionized Chevrolet's passenger car line in 1955, there were several differences worth noting. When installed in a Corvette, the 265-cubic-inch (4,342.6cc) powerplant was equipped with a four-barrel carburetor and tuned to produce 195 horsepower. It was also distinguished by a chrome-plated ignition shield over the distributor to reduce radio interference, chrome valve covers, a chrome air cleaner cover, an unusual chrome-covered ignition coil, and a unique heater shut-off valve spliced into the heater hose.

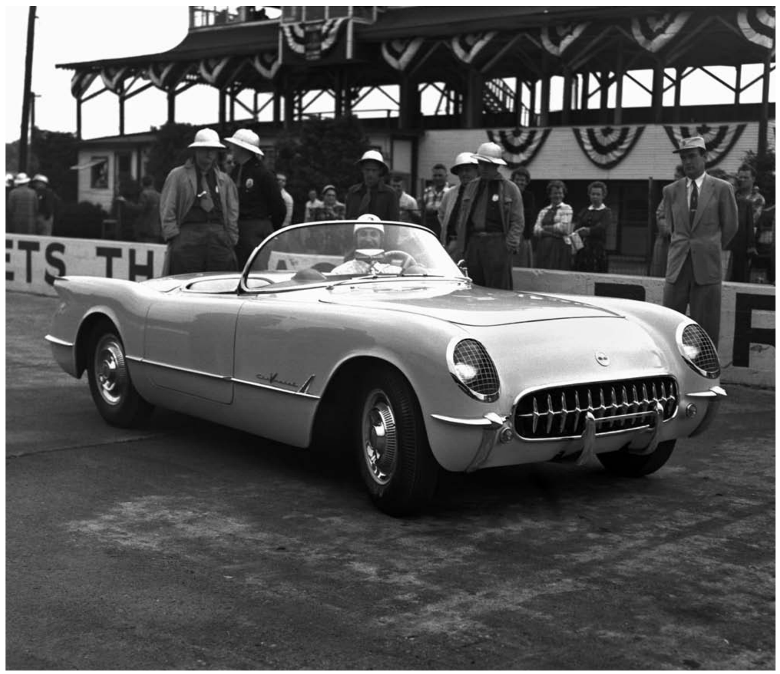
The exteriors of the V-8-powered 1955 Corvette were distinguished from the handful of six-cylinder Corvettes by a large gold V in the Chevrolet script on both front fenders. Each car also had the letter V at the beginning of its serial number.

All 1953 Corvettes had been painted Polo White, likely to simplify production and help obscure poor body fit and finish. After assembly got underway at the St. Louis plant in 1954—and body quality improved—buyers could have Pennant Blue, Sportsman Red, or black instead of white. Black was dropped the next year, Gypsy Red replaced Sportsman Red, and, in April 1955, Pennant Blue was replaced by two new colors, Corvette Copper and Harvest Gold.

Inside, the 1955 Corvette looked nearly identical to its predecessors, with the same centrally located speedometer and array of smaller instruments spread across the dash. An important but unseen difference when compared with previous models lay in what powered the gauges, the radio, and all the car's other electrical components: 1955 heralded the substitution of a twelve-volt electrical system in place of the former six-volt configuration. This increased voltage made engine starting easier and prepared the car to meet the increased electrical demands that future accessories would impose.

Chevrolet's new V-8, an expanded color palette, and the switch to twelve-volt electronics were certainly welcome improvements, but the fundamental problems that had hampered Corvette sales the previous year remained challenges for 1955. These included prodigious water leaks when it rained, considerable wind noise at highway speeds, the inconvenience of plastic side curtains rather than roll-up windows, an awkward convertible top system, and the absence of exterior door handles, door locks, and any power assists or other luxury options. Most of these problems would not be addressed for another year, but for the first time in its young life, there was hope for Corvette. A comprehensive redesign in 1956 that updated styling, enhanced comfort, and improved performance would ultimately secure Corvette's position in the marketplace, and in the hearts of enthusiasts.





◀◀ This Keller machine, located in Chevrolet's Detroit Forge plant on St. Aubin Street in Detroit, was a three-dimensional duplicator that followed the contours of the resin master above to accurately machine a Kirksite die below. Male and female matched metal Kirksite dies were used to manufacture Corvette body panels beginning in 1954, which substantially improved their appearance and strength.

◀ After winning the Indy 500 three times, Maury Rose, behind the wheel of a 1955 at Indy, retired from competition and went to work for Chevrolet as a development engineer, helping transform Corvette into a reliable and formidable high-performance car.

3

ON THE PATH TO SUCCESS

1956–1962

Though Corvette's interior layout was not dramatically changed for 1956, extensively revised exterior styling with bold new concave coves sculpted into each side of the body gave the car a more purposeful appearance. While extremely well received by the motoring press and public alike, these changes for 1956 went beyond cosmetics. The passenger seat had fore-and-aft adjustment for the first time, the interior heater took in outside air rather than just recirculating inside air, the AM radio used transistors instead of tubes, proper roll-up windows replaced delicate and somewhat awkward Plexiglas side curtains, the doors got exterior handles and locks, and a revised soft top frame was much easier to put up and down. Buyers could even have optional electric power windows, an electric-hydraulic power top, and an auxiliary hardtop that dramatically improved weather sealing.

◀ The hood ridges and twin chrome-plated trunk irons, seen on this very rare and extraordinarily original 250-horsepower fuel-injected example, are unique to 1958.

While Corvette's fundamental chassis design was unchanged for 1956, several subtle but important revisions appeared this year, largely because of development work done by Zora Duntov and his colleagues. When introduced in 1953, the chassis had 15 percent roll understeer in the rear suspension, which caused the car to roll and yaw with steering input. In normal street driving this was largely inconsequential, but at high speeds sudden steering input resulted in both roll oscillation and yaw oscillation, causing the car to go into an unsettling corkscrew motion. To eliminate this, Duntov took out the rear roll understeer by raising the rear leaf spring's front anchor points and added slightly more front understeer by increasing the front wheel caster. The result was a car with more neutral, predictable handling when taken to its limits.

With the benefit of further development, again led by Duntov, Chevrolet's original 1955 V-8 only improved in later years. For 1956, thanks to an increase in compression from 8.0:1 to 9.25:1, revised cylinder heads, a different Carter four-barrel carburetor, and a new camshaft profile, the base 265-cubic-inch (4,342.6cc) engine produced 210 horsepower, up from 1955's 195-horsepower rating. For $172.20 above the car's base price of $3,120.00, buyers could have a 225-horsepower V-8 fitted with twin four-barrel carburetors atop an aluminum intake manifold; 3,080 of the 3,467 Corvettes produced in 1956 came with this optional engine. Of these, 111 cars also got the "Special High-Lift Camshaft" option, which added another $188.30 to the manufacturer's suggested retail price (MSRP) and increased output to 240 horsepower.

▼ Legendary Corvette Chief Engineer Zora Duntov, seen here wearing a finely tailored suit and catching air at the Milford Proving Ground in Chevrolet Engineering car #856, the second prototype Corvette built, was a tireless, passionate advocate for Corvette.

For 1957, Chevrolet enlarged the V-8 engine's bore from 3.750 inches (9.525 centimeters) to 3.875 inches (9.842 centimeters), which combined with a 3.000-inch (7.6 centimeter) stroke to yield a displacement of 283 cubic inches (4,637.5cc). The base engine was fitted with hydraulic lifters and a four-barrel carburetor for a rating at 220 horsepower. The choice of optional engines expanded to include two dual-quad versions, so called because they had two four-barrel carburetors. The first had a mild hydraulic cam and produced 245 horsepower, while the second used a more aggressive, solid lifter cam and higher compression to yield 270 horsepower.

The big engine news for 1957, however, was the availability of Rochester Products Division mechanical fuel injection, which cost an eye-opening $484.20. The origins of fuel injection go back to the 1880s, with the work of pioneers like Frederick William Lanchester at the Forward Gas Engine Company in Birmingham, England, E. J. Pennington, and Herbert Akroyd Stuart. Developed for his heavy oil engine, Stuart's injection system was the first to resemble modern setups, with later advancements made by Robert Bosch to improve on Rudolph Diesel's "air-blast" system. By the early twentieth century, fuel injection was commonly used for diesel engines and also applied experimentally for gasoline-fueled aircraft engines. Interestingly, the four-cylinder engines the Wright Brothers designed and constructed to power their pioneering flights were fed fuel by a simple injection system. The urgencies of war significantly advanced the technology, particularly in World War II, and by the early 1950s a commercially viable system from Bosch was being used by Mercedes.

Ed Cole, who was promoted from Chevrolet chief engineer to a vice president of General Motors and general manager of its Chevrolet Division on July 1, 1956, spearheaded the effort to develop fuel injection for GM vehicles. To accomplish that he marshalled the engineering resources of various GM divisions, including Rochester Products, Delco-Remy, Packard Electric, and of course Chevrolet. Harry Barr, who replaced Cole as Chevrolet chief engineer, played a prominent role, as did brilliant engineers John Dolza and Zora Duntov, who together did much of the hands-on design and development work.

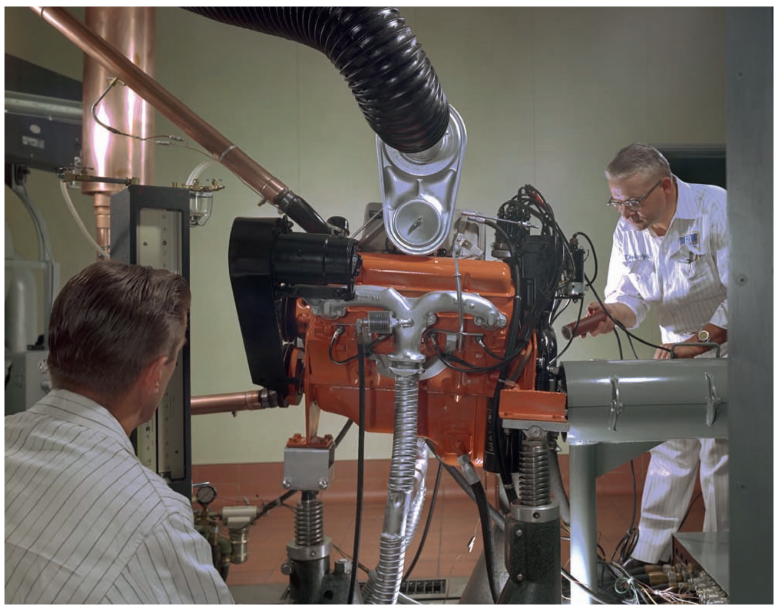
The result of their efforts was a reliable and effective fully mechanical, continuous-flow, port fuel-injection system offered as an option for Corvette from 1957 to 1965. In 1957, the milder fuel-injected engine was rated at 250 horsepower and the high-compression, mechanical lifter version delivered an impressive 283 horsepower, making it one of the first mass-produced engines to yield at least one horsepower for each cubic inch of displacement.

The three-speed manual gearbox first offered late in model year 1955 became the standard transmission for 1956, with the two-speed Powerglide available for an extra $188.50. Beginning in April 1957, buyers could also select a four-speed manual, priced at $188.30. The new four-speed, a Borg-Warner T-10, was relatively light thanks to its aluminum case and featured fully synchronized gears.

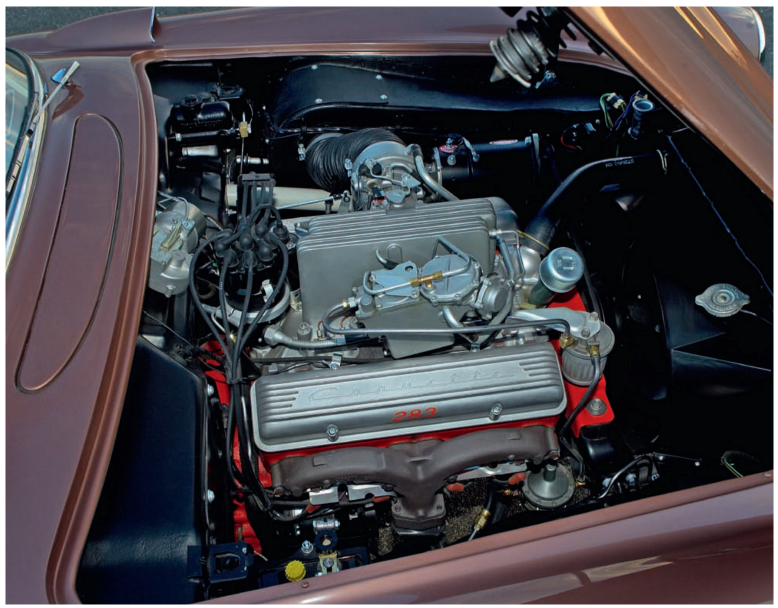
For the first time, the new four-speed's twist could be channeled through a limited-slip Positraction axle, with several gear ratio choices ranging from 3.70:1 to 4.56:1. In competition, the new fuel-injected engine, four-speed gearbox, and Positraction axle could be combined with RPO 684, an optional heavy-duty brake-and-suspension package that included higher-rate front and rear springs, higher-capacity shock absorbers, a larger-diameter front stabilizer bar, a quick-steering adaptor, metallic brake linings, finned brake drums, vented brake backing plates, and wider wheels, sized at 5.5 inches (13.97 centimeters) instead of the standard 5 inches (12.7 centimeters). Only fifty-one Corvettes were produced with this $780.10 heavy-duty brake-and-suspension option in 1957.

Corvette buyers who wanted the ultimate performer in 1957 checked off one more box on the option list. For $726.30 they got RPO 579E, the high-horsepower fuel-injected engine and a cold air package. These so-called airbox cars were fitted with a large and somewhat crude fiberglass box assembly in the engine compartment; the airbox received outside air from an opening at the front of the car and distributed it to the engine's intake system and then, by means of rather complex fiberglass ductwork that went through the body's rockers, to the rear heavy-duty brakes. The heavy-duty front brakes were cooled by a scoop bolted to the backing plate. Only forty-three cars with both RPO 681 and RPO 579E were produced in 1957, and approximately seven more 1957 Corvettes were made with the airbox and fuel injection, minus the heavy-duty brake-and-suspension package.

▲ In 1957 Chevrolet's marketing people and their advertising agency, Campbell-Ewald, found their voice. There's no doubt which foreign sports cars they were targeting with this ad.



◀◀ Rochester Products mechanical fuel injection, undergoing evaluation in a GM dynamometer cell, was optional from 1957 to 1965.



◀ This extremely rare 1957, beautifully restored by Vette Dreams in Babylon, New York, exhibits several interesting features, including a fiberglass airbox mounted to the inner wheel housing to provide cool, outside air to the fuel-injection unit; a heater block off plate on the firewall, fitted to those cars built without the optional heater; and the absence of metal ignition shielding around the distributor and spark plug wires, indicating that this car doesn't have the optional AM radio.

▲ A 1957 undergoing cooling system tests in a climatic wind tunnel was part of the complex, ongoing efforts to improve every aspect of Corvette's performance.

CORVETTE GETS A FACELIFT

Though 1956 and 1957 Corvettes had their fair share of chrome trim, the bodies were relatively simple and devoid of nonfunctional features other than a small scoop atop each fender. Significant styling changes introduced in 1958 moved away from the simplicity that characterized prior Corvettes. The cars got four headlights instead of two, and chrome headlight surrounds mated to polished stainless trim ran atop the full length of each front fender. The liberal application of chrome continued with twin trunk irons, a trio of chrome spears in each side cove, much larger front and rear bumpers, and relatively large chrome trim pieces surrounding the toothed front grille and the recesses astride it. Race-inspired but entirely nonfunctional additions included ridges on the hood to simulate cooling louvers and recesses in the side coves meant to evoke air outlets. The inclusion of gargantuan fins and other grossly exaggerated body features, pervasive use of chrome trim, and the infusion of faux features peaked for most GM vehicles in 1959. Corvette's designers took an unexpected step back from this look, though, and the simulated hood louvers and chrome trunk irons introduced in 1958 were eliminated for 1959.

While the quad headlight treatment introduced in 1958 remained through 1962, a number of significant changes were made for 1961 and 1962 models. The toothed grille that had been used since 1953 was replaced with a more elegant aluminum stamping, anodized silver in 1961 and black in 1962. In 1962 ribbed trim at the front of the side coves and matching rocker trim were added. That same year saw the elimination of the stainless trim outlining the side coves and the optional contrasting color cove paint. The biggest change for the 1961 and 1962 bodies was the dramatic redesign of the rear: the rounded quarter panels and trunk lid gave way to sharply peaked arches above the wheels, a sharp horizontal crease separating the quarter panels' upper and lower halves, and a nearly flat trunk. The new design was directly derived from the 1959 *Sting Ray* racer and signified where Corvette was headed with the C2, which would be introduced in 1963.

Corvette's interior changed just as dramatically as its exterior in 1958. All the instruments were contained in a single housing located directly in front of the driver, rather than spread across the dash as before. A center stack housed the optional radio as well as the clock and heater/defroster controls. A deep recess in the passenger side dash mirrored the driver side, giving the car's cockpit an aircraft sensibility.

Very little had changed underneath the new body for 1958. A number of versions of the 283-cubic-inch (4,637.54cc) V-8 were available, from the base 230-horsepower unit all the way up to a high-compression, solid-lifter, mechanically fuel-injected engine that delivered 290 horsepower. In 1962 the engine was enlarged to 327 cubic inches (5,358.57cc), which helped boost power output for the base engine to 250 horsepower and the high-output fuelie to an impressive 315 horsepower. A three-speed manual gearbox remained standard, with Chevrolet's two-speed Powerglide automatic or four-speed manual optional.

The heavy-duty chassis option introduced in 1957 remained available through 1962, but it did evolve over time. This racing-oriented package included quick-ratio steering and 5.5-inch (13.97-centimeter) wheels in place of the standard 5-inch (12.7-centimeter) rims. Higher-rate springs were installed in 1957–1959 models and again in 1962. In 1960 and 1961 all Corvettes got a rear anti-sway bar and cars equipped with the optional heavy duty brake and suspension package got standard rate springs. A unique braking system that included vented backing plates and finned drums was included with the heavy duty brake-and-suspension option for all years, with earlier backing plates using a finer mesh screen that covered the vents and earlier drums having cooling fins that wrapped around their faces. The earlier parts were used through the end of 1958 or possibly into early 1959. Riveted Cerametalix brake linings were used from 1957 to 1959, riveted metallic linings were used in 1960 and 1961, and bonded metallic linings appeared in 1962. As in 1957, a complex fresh-air ducting setup that brought cooling air to the rear brakes was available in 1958, but this was eliminated in 1959. From 1959 to 1962 the rear brakes were cooled by a simple duct mounted to the rear of each backing plate.

◀◀ Comprehensive interior restyle introduced in 1958 began the twin-cockpit motif that endures to this day.

◀ Though the St. Louis assembly plant was larger, better equipped, and more modern than the Flint facility, Corvettes were still built entirely by hand there.

▼ A dramatically revised rear-end design used in 1961 and 1962 foreshadowed the completely new body that would be introduced in 1963 with the second-generation Corvette.

4

CORVETTE

GOES RACING

All of the improvements made to Corvettes, beginning with the introduction of Chevrolet's fantastic V-8 in 1955 and continuing with the many comfort and performance enhancements added in 1956 and 1957, were essential if the nameplate was to survive. But building better cars alone was not enough. Chevrolet, with its unparalleled expertise in selling economical transportation to the masses, still had no real experience marketing a low-volume sports car to enthusiasts. This was expertise it needed to develop, quickly.

◀ In December 1955 Betty Skelton, Zora Duntov, and John Fitch set numerous top speed and acceleration records at Daytona Beach, helping build Corvette's reputation as a genuine performance car.

While Chevrolet's marketing people did not know what to do with Corvette, men like Ed Cole, Harley Earl, and Zora Duntov knew the car's destiny could be altered, and they knew exactly how to accomplish that. Rather than trying to be all things to all people and in reality being too little to too few, it needed to be given the personality of a high-performance sports car and enthusiastically marketed as such through racing.

Duntov led the charge in this regard, as evidenced by his September 1953 address at a meeting of the Society of Automotive Engineers in Lansing, Michigan. "All commercially successful sports cars were promoted by participation in racing with specialized or modified cars," explained the recent addition to Chevrolet's engineering staff. "Even if the vast majority of sports car buyers do not intend to race them, and most likely will never drive flat out, the potential performance of the car, or the recognized and publicized performance of its sister—the racing sports car—is of primordial value to its owner. The owner of such a car can peacefully let everybody else pass him, still feeling like the proud king of the road, his ego and pride of ownership being inflated by racing glory."

The first time a Corvette was wheeled around a racetrack in earnest was likely May 1954, when Dr. Dick Thompson did a few demonstration laps at Andrews Field outside Washington, D.C. "I was there racing my Porsche," Thompson later recalled, "and a local Chevy dealer brought out a '54 Corvette with the old six-cylinder and Powerglide transmission just to demonstrate, not to race, and I was given the chance to take it around the course for a few laps."

Corvette made its international racing debut in November 1954 when legendary speed shop owner Bill Von Esser courageously entered a Corvette in the fifth running of the brutal Carrera Panamericana. He and copilot Ernest Pultz came to an abrupt stop on the first of the race's eight legs when the car's Stovebolt Six engine pitched a connecting rod through the cylinder case.

Chevrolet dealer Addison Austin had better luck racing a V-8–powered Corvette in 1955. Competing against Jaguar 120s and Mercedes 300 SLs, he finished seventh in class, tenth overall at Watkins Glen in September. He then managed third in class at Thompson and a remarkable first in class at Hagerstown.

Chevrolet finally got into the game in December 1955. Early that month, John Fitch flew to Detroit where he, Briggs Cunningham, and three-time Indy 500 winner Mauri Rose met with Chevrolet Chief Engineer Ed Cole at the Milford Proving Ground. Cole enlisted Fitch to lead a four-car Sebring entry. He also signed up Fitch to join Duntov and Betty Skelton for a three-car speed and acceleration effort at Daytona Beach later in the month. The trio set various top-speed and standing-mile acceleration records, and Duntov returned to Daytona in January 1956 to drive a 1956-bodied engineering mule to a two-way average speed of 150.583 miles per hour (242.34 kilometers per hour).

Shortly after the record runs at Daytona, Fitch returned to Florida to face what he called "the most intense challenge of my entire racing career." He was responsible for making Corvette into an endurance racer capable of holding its own with the best European cars of the era. Of this experience Fitch said, "From the very outset of our preparation for Sebring, two things were apparent: Corvettes, as they were being delivered from the factory for all-round touring were not, however, equipped or prepared for the specialized rigors of a big-league endurance race, and we had practically no time in which to make them so. Yet that was our task, and it had to be accomplished between the 18th of February and race day, March 24, 1956."

Against all odds, Fitch, his teammates, and mechanics and engineers provided by Chevrolet rose to the occasion. Twelve long hours after Sebring's brutal battle of man and machine began, two of the four Corvette entries, limping badly from their ordeal, defiantly crossed the finish line and proved to the entire world that Chevrolet's experiment in fiberglass was for real. Fitch and Walt Hansgen finished first in class and ninth overall, and Max Goldman and Ray Crawford nursed their Corvette to a sixth in class, fifteenth place overall finish.

Encouraged by their success at Sebring, Chevrolet reached an agreement with Dick Thompson to drive a Corvette for the remainder of the 1956 SCCA season. "They sold me the car at a very reasonable price, supplied parts and a mechanic, and took the car back after each race to evaluate it," recalled Thompson.

The Washington, D.C., dentist's first race with Corvette was at Pebble Beach. "I was very impressed with the car right from the start," he remembered. "Strangely enough—and people don't believe this—it was a very good handling car. The power-to-weight ratio was actually better than the 300 SL and many other fast cars of that era. The only thing it didn't have was brakes."

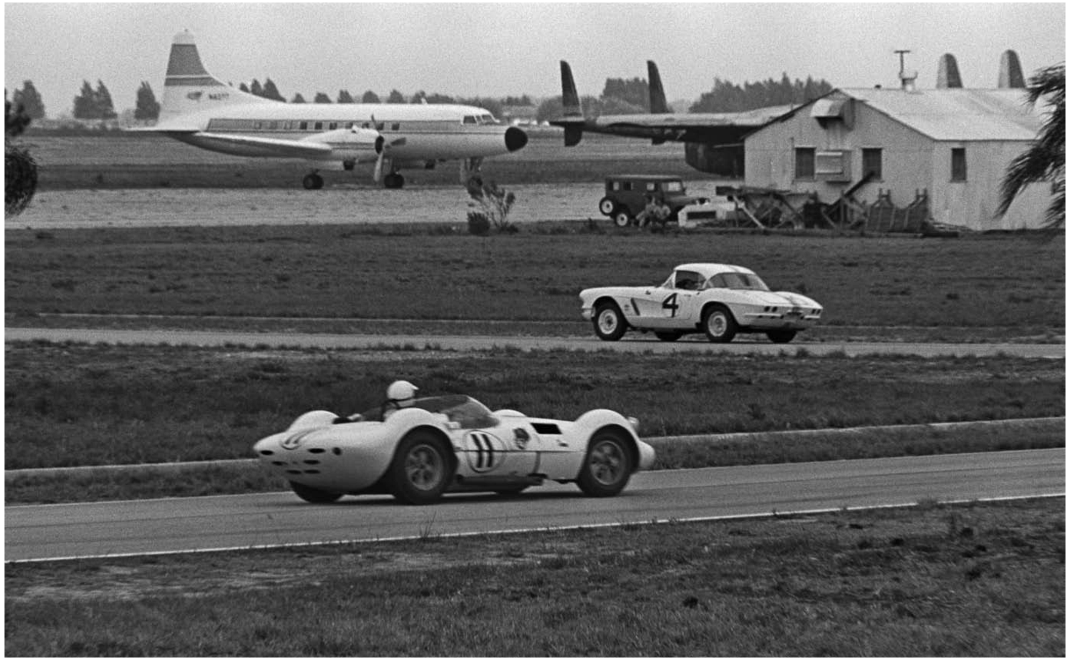
The night before the race, Chevy engineer Frank Burrell installed Cerametalix brake linings that extended the useful life of the brakes to about one hour under racing conditions. Thompson shocked everyone on race day by starting sixth and then coming around after the first lap in the lead. He held that position until the last lap, when the brakes disappeared, but he managed to hold on for second place behind Tony Settember's Mercedes. "When the race was over, I killed the engine in the pits to stop the car. When we pulled a drum off, all the brake parts just fell out on the ground!" Inadequate brakes continued to plague racing Corvettes for years to come, but the crash development program orchestrated by Fitch in preparation for Sebring in 1956 resulted in many worthwhile improvements. By season's end, Thompson had earned the C-Production SCCA national title.

In 1957 the already fast Corvettes got even faster because of new competition options offered, including Rochester fuel injection, a four-speed gearbox, and a heavy-duty brake-and-suspension package. For this racing season the SCCA Contest Board rearranged the classes, moving Corvettes and Jaguars into their own newly created grouping, called B-Production. "The realignment didn't really make any difference to us," noted Thompson, "because we could handle any other production car without any problems regardless of how it was classified." At season's end Thompson won his fourth national championship in only his fifth season of racing.

Just as Corvette was finding its stride as a top production-class racer, the playing field changed dramatically. In June 1957 the Automobile Manufacturers Association (AMA) adopted a ban that prohibited its members, including GM, from racing. In spite of only limited factory support, however, a number of competitors continued racing Corvettes in the years following the ban. Charismatic Jim Jeffords wheeled his "Purple People Eater" Corvette to consecutive SCCA B-Production national titles in 1958 and 1959. In 1960 Bob Johnson won the B-Production national championship, while Dick Thompson beat some of

◀ The 1957 Sebring 12 Hour class-winning Corvette of Dick Thompson and Gaston Andrey gets fuel and new tires in a pit stop that looks very simple by today's standards.

▲ Four Corvettes competed in the 1957 12 Hours of Sebring, including two production-class entries, an *SR-2*, and the *Corvette SS*.



▲ Dallas Chevrolet dealer Delmo Johnson and Tulsa insurance executive David Morgan raced Corvettes together for many years and finished third in class in the No. 4 car at Sebring in 1962.

▶ Duncan Black and M. R. J. "Doc" Wylie drove the No. 2 Gulf Oil entry to first in the large-displacement production class at Sebring in 1962.

the best sports racers in the world to earn the SCCA Class C-Modified national championship that year. In clear defiance of GM's adherence to the AMA ban, Thompson drove the stunning *Sting Ray* racer as a privateer entry. The *Sting Ray* body was a styling prototype that served as the basis for the production 1963 Corvette and its chassis came from the development mule for Chevrolet's 1957 *Corvette SS* racer. GM design chief Bill Mitchell put the body and chassis together, bought the car from Chevrolet, and then hired Thompson to drive it.

Corvette also continued to enjoy success at Sebring despite the AMA ban. Doane and noted Indy competitor Jim Rathmann earned class honors there in 1958. In 1960 Jim Hall and Bill Fritts did the same, and the next year Dallas Chevrolet dealer Delmo Johnson and Dave Morgan brought their Corvette home first in class and eleventh overall. In 1962 one of the legendary Gulf Oil Corvettes, driven by Duncan Black and M. R. J. Wylie, earned a Sebring class win.

The Gulf Oil team, led by Grady Davis, benefited from the resources of Gulf's Harmarville Labs, one of the most advanced research and development facilities in the world. Besides class victory at Sebring, Gulf Oil Corvettes won the SCCA B-Production national championship in 1961 and 1962, and the A-Production title in 1962.

Before Corvette's first chapter closed, it also earned top honors at the most difficult sports car race of them all. In 1960 Fitch and Bob Grossman won GT at Le Mans in one of Briggs Cunningham's Corvettes.

Corvette's first generation ended a lot better than it began, with sales increasing significantly every year from 1956 through 1962. Chevrolet went from having to contend with some twelve hundred unsold Corvettes at the end of 1954 to selling an impressive 14,531 cars in 1962, a change due in large measure to the people who took the car racing. They showed the world that Chevrolet's little fiberglass two-seater was much more than just a pretty face. These pioneers demonstrated that it was a true high-performance machine capable of winning races, and in so doing transformed Corvette from a floundering failure to a rousing success.

▲ Renaissance man John Fitch—World War II fighter pilot, inventor, entrepreneur, and highly successful racer—was enlisted to drive a Corvette at the Daytona speed runs in December 1955 and manage the Corvette team entries at Sebring in 1956 and 1957.

◀ Corvette's first victory in the 24 Hours of Le Mans came in 1960, when the No. 3 Briggs Cunningham entry was driven by John Fitch and Bob Grossman to first in the large-displacement GT class.


1

5

C1 STYLING

AND ENGINEERING SPECIALS

During the 1952 United States Senate confirmation hearing that followed his nomination by President Eisenhower to become secretary of defense, former GM President Charles Wilson confidently stated, "What was good for the country was good for General Motors and vice versa." Those words succinctly captured GM's position of utter domination in the United States automobile industry—where it held a market share greater than 50 percent—and in the American economy as a whole. Simply stated, in the years following the conclusion of World War II, GM was the wealthiest and most powerful corporation in the world.

◀ Zora Duntov, *right*, oversaw the design and construction of the 1957 *SS* and John Fitch, *left*, co-drove it in the 1957 12 Hours of Sebring with Piero Taruffi.

During the 1950s, GM's standing manifested itself in spectacular fashion with the creation of magnificent styling and engineering specials. These were dream cars that allowed the company's stylists and engineers to stretch their imaginations to the extreme, and a number of noteworthy examples bore the Corvette nameplate.

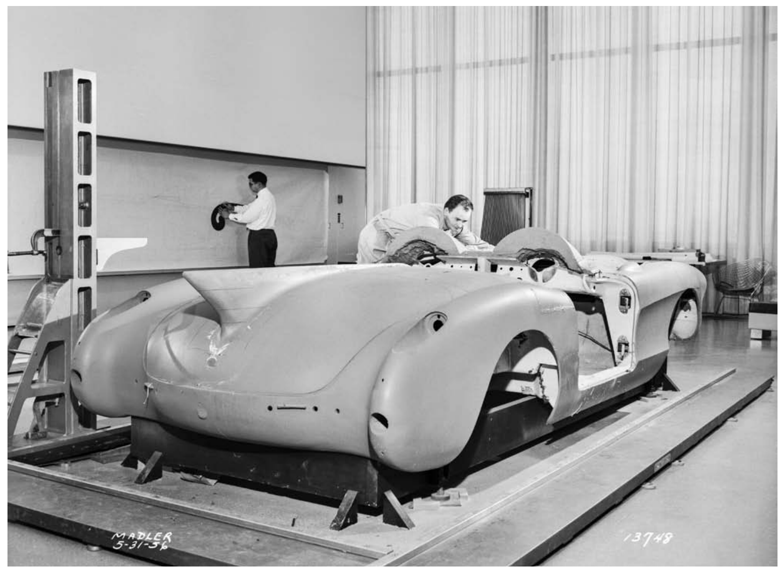
1956 *SR-2*

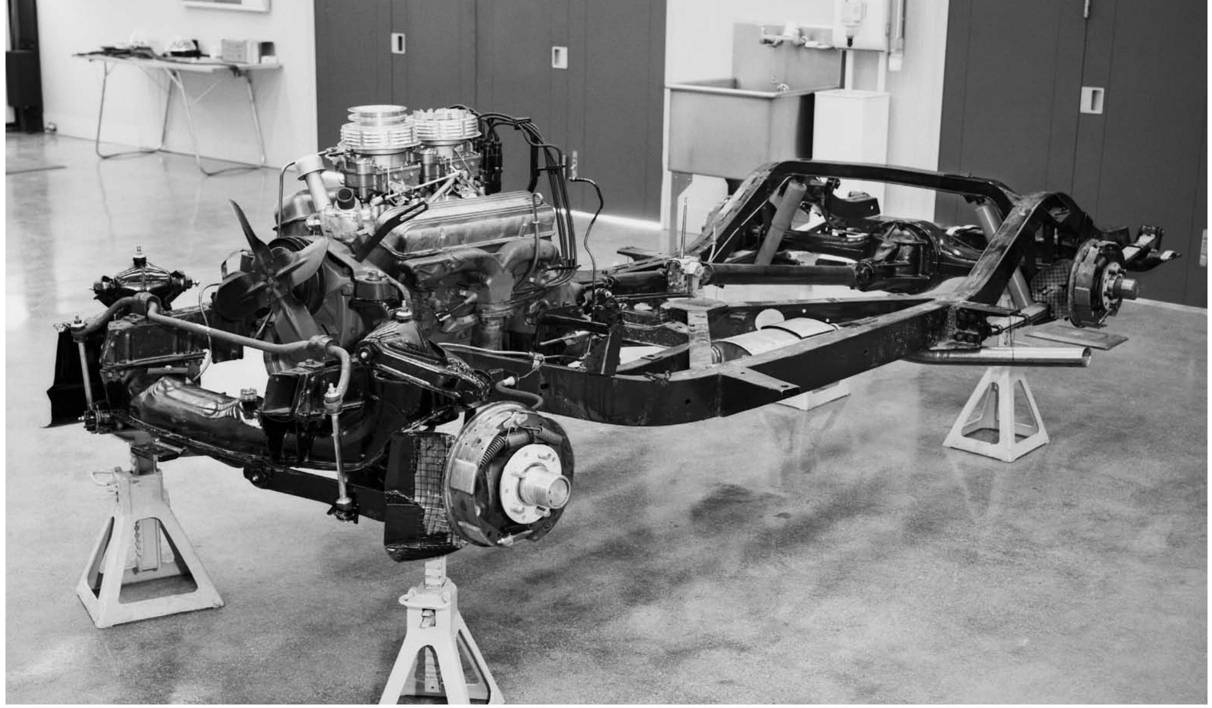
Harley Earl headed GM Design from its creation in 1927 through his retirement in 1958. He was a larger-than-life figure who likely exerted more influence over automotive styling than any other individual in history. He was also the driving force behind the creation of the Corvette in 1953. Though his focus was on styling, Earl played a key role in Corvette's evolution into a viable road racer. Early in 1956 his youngest son Jerry bought a Ferrari to race, which did not sit well with dad. To get him out of his Italian car and into a GM product, the design chief had Chevrolet build a modified production Corvette suitable for racing. Called *SR-2*, it utilized the heavy-duty brake-and-suspension components developed for the John Fitch-led four-car entry at Sebring in 1956. Earl's *SR-2* also featured mechanical fuel injection, brake cooling ducts, and Halibrand magnesium knock-off wheels. It also came with various body modifications designed by Robert Cumberford, including a short, central rear fin atop the trunk (which later changed to a large fairing offset to the left to provide a headrest for the driver), 14-inch (13.56-centimeter) nose extension, vented hood, domed headlamp covers, and polished aluminum side cove inserts with scoops to channel cooling air to the rear brakes.

Painted a beautiful shade of metallic blue, the first *SR-2*, bearing 1956 serial number E56S002522, had a storied life. The car made its racing debut at Road America's June Sprints, in the main six-hour event, with Jerry Earl and Dick Thompson driving. After Curtice Turner drove it at the November 1957 Nassau Speed Weeks, the car was sold to 1958 SCCA B-Production national champion Jim Jeffords, who raced it as the first of his four Nickey Chevrolet–sponsored "Purple People Eaters." Later in 1958 Jeffords sold it to Bud Gates, who raced it in 1959 and 1960. Gates then put the unusual Corvette on his used car lot at Bud Gates Chevrolet in Indianapolis and sold it to Vernon Kispert, who took it drag racing as the "Terror of Terre Haute." In 1969, after several years of hard use on drag strips, the car ended up for sale in front of a salvage yard in Terre Haute and was purchased by Gene Marquis. Well-known Corvette collector Rich Mason bought it in 1986, finished the restoration, and actively vintage-raced the historic car until 2013.

▶ Clay modeling underway for the first 1956 *SR-2*, which was both a styling and an engineering exercise initiated by GM Design leader Harley Earl.

▶▶ The first *SR-2* body, designed primarily by Robert Cumberford, featured a low, central fin on the trunk, while the second *SR-2* had a large fairing offset to the left to provide a headrest for the driver.





In the fall of 1956, another *SR-2* was built, this one for Bill Mitchell, who succeed Earl as head of GM Styling in 1958. This *SR-2* proved more competitive than the first one, largely because it was some 300 pounds (136.08 kilograms) lighter thanks to thinner fiberglass body panels and a spartan interior. As with the first car, the Mitchell *SR-2* used many of the parts in the heavy-duty brake-and-suspension kit that would be offered as a regular production option beginning in 1957, but with a few modifications, including finned aluminum brake drums and supplementary rear Houdaille rotary dampers. Power came from a Smokey Yunick–built, fuel-injected 283-cubic-inch (4,367.54cc) V-8.

The Mitchell *SR-2*'s first outing was in December 1956, at Nassau's seventy-mile Governor's Trophy Race, where it finished tenth overall. Two months later, two-time NASCAR Grand National Series champion Buck Baker drove it at the Daytona Speed Week, achieving an average standing-mile speed of 93.047 miles per hour (149.744 kilometers per hour) and a flying mile speed of 152.886 miles per hour (246.046 kilometers per hour). In March of 1957 it was driven by Paul O'Shea and Pete Lovely to sixteenth overall in the 12 Hours of Sebring.

This *SR-2* was sold after GM agreed to the AMA ban on racing, eventually ending up in the hands of Don Yenko's pilot, Cookie Knuth. In 1980 noted Corvette collector and historian Bill Tower bought it from Knuth and remains its caretaker to this day.

GM President Curtice was impressed enough with the *SR-2* to have one built for himself, but the Curtice example was a styling exercise only, devoid of the competition components found on its predecessors. It differed from the other two cars in that it had a low fin, similar to the one initially worn by the Earl *SR-2*, and Dayton wire wheels instead of Halibrand knockoffs. It also had a far more luxurious interior, featuring carpeting, leather upholstery, and seat belts.

CORVETTE SS

In the fall of 1956 Harley Earl acquired a Jaguar D-Type from Indianapolis racer Jack Ensley. D-Types had won the 24 Hours of Le Mans in 1955 and 1956, and the iconic British cars would go on to thoroughly dominate the 1957 race, with five works-supported privateer entries finishing first through fourth and sixth. Earl contemplated installing a V-8 Chevrolet engine in the Ensley car, but this did not sit well with Duntov, who thought Chevrolet should design and build its own racing car from scratch. With the support of Cole and others in GM management, Duntov was given the green light to do exactly that. The car they created would be called the *Corvette SS*.

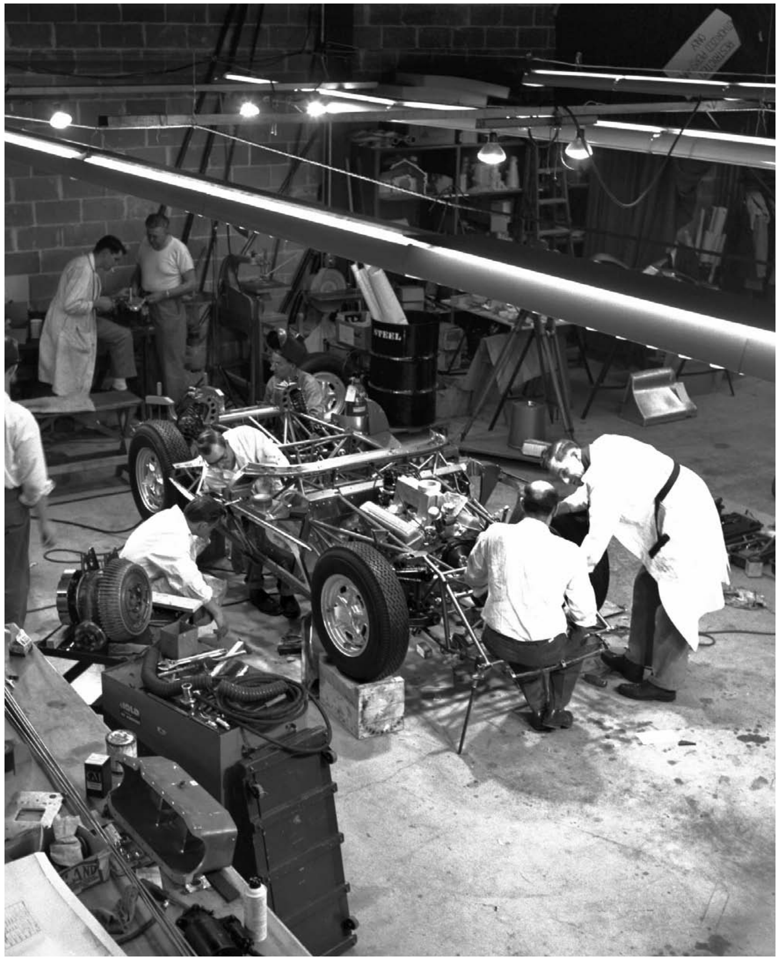
◀ This 1956 *SR-2*, built for GM Design leader Bill Mitchell, was the second of three produced. It finished sixteenth overall at Sebring in 1957.

▲ The first SR-2 was constructed using this production 1956 chassis fitted with the heavy-duty brake-and-suspension components developed initially for the 1956 Sebring Corvettes and offered as a factory option package beginning in 1957.

▶ A handpicked team of engineers and technicians worked long hours to design and fabricate two chassis for the 1957 *Corvette SS*, one for a test mule and the second for the magnesium-bodied racer.

▶▶ The body for the 1957 *Corvette SS* was designed and fabricated at GM Design, and then assembled there using the chassis produced by Chevrolet Engineering.

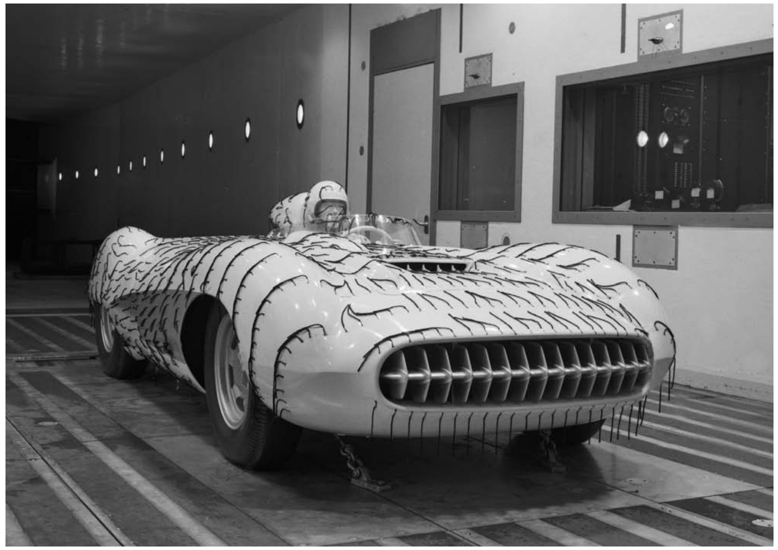
▼ Because the body for the *Corvette SS* was behind schedule to make its competition debut at the 1957 Sebring 12-hour race, Chevrolet built a crude temporary body from fiberglass to mount on the spare *SS* chassis and serve as a test car.



Duntov and a handpicked team of engineers and technicians worked tirelessly to design and fabricate a chassis in their walled-off workshop inside the Chevrolet Engineering Center. At the same time, a small group led by Bob McLean labored on the new car's body at Design Staff. They were all straining to get the car done by March of 1957, in time to compete at Sebring.

The new car's tubular space-frame chassis design borrowed heavily from the Mercedes 300 SL and, to a lesser extent, the D-Type Jaguar, with modifications to accept the Chevrolet V-8 and bespoke de Dion rear suspension and short-arm/long-arm front suspension. The body, which would be fabricated from magnesium to minimize weight, was designed to slip through the air as efficiently as possible and underwent extensive wind tunnel testing to ensure proper performance. To maintain the car's looks, McLean and his colleagues were careful to incorporate some important production Corvette styling cues, including body side coves and a grille crafted from chrome-plated teeth.

Because body design, fabrication, and testing took considerably longer than the chassis build, a second chassis was built and combined with a crude fiberglass body for testing. Known as "the mule," this test car was driven some 2,000 miles and the lessons learned were transferred to the other *SS* chassis, with the hope that it would prove reliable and competitive at Sebring. Unfortunately, it didn't.



◀◀ The *Corvette SS* was extremely fast but, owing to its late completion and resultant complete lack of testing, it ran only twenty-three laps at Sebring before a rear-suspension lateral control link bushing failed and the car was retired.

◀ Though unsuccessful on the racetrack, the 1957 *Corvette SS* did a lot to advance the knowledge of the engineers and designers who crafted it, including their understanding of aerodynamics.

The completed *SS* finally arrived at Sebring on March 22, 1957, a day before the 12-hour race. It was finished to the highest standards, with its metallic blue paint and polished trim gleaming magnificently on the starting grid, but its complete lack of testing would prove fatal. Only three laps in, driver John Fitch had to pit after flat-spotting a front tire that locked up because of inconsistent brake performance. Several laps later Fitch came in again, this time with a dead engine. The problem was traced to a faulty ignition coil condenser. Once back on track, the car turned competitive lap times, but the engine quit again. In keeping with the rules, only the driver could work on a car that broke on the track, so it was up to Fitch, who got it going again by replacing the ignition coil. Piero Taruffi took over when Fitch pitted on lap 21 for fuel, but the highly skilled Italian only completed two more laps before a rear suspension lateral control link bushing failed, making the car impossible to drive at high speed. Given the time it would have taken to replace the bushing, the team retired the car, marking an inauspicious end to a highly ambitious project.

A little more than two months later, GM signed on to the AMA agreement not to race, so the *Corvette SS* did not get a chance to redeem itself. Though its outing at Sebring was a disaster by any measure, the lessons learned would prove invaluable when Chevrolet got back into the racing game in later years. The mule chassis went on to demonstrate what the *SS* was capable of when it got rebodied as the *Sting Ray* racer in 1959.

STING RAY

The *Corvette SS* and its sister, the *SS* test mule, both returned to Chevrolet Engineering after the 1957 Sebring race. The mule's crude fiberglass body was discarded and its chassis completely rebuilt, reportedly in preparation for a Le Mans entry. The 24-hour classic was to take place on June 22–23, 1957, but Corvette would not be there owing to Chevrolet's adherence to the AMA prohibition against racing. The race-ready *SS* chassis sat idle for more than a year and may have disappeared into the dustbin of history were it not for the efforts of GM Design Staff leader Bill Mitchell.

Mitchell arranged to buy the chassis from GM and race it as his own privateer entry. The starting point for the body that would ultimately grace the *SS* racer's tubular space-frame chassis was derived from Peter Brock's 1956 design for the Cadet, a diminutive car intended for students, which had made it to a full-size mockup but was never built. Elements of Brock's design were incorporated into the ill-fated Q Corvette, created late in 1957 by a team of young designers that included Brock and Bob Veryzer, in the Research Studio

▲ The 1959 *Sting Ray* racer, seen here in its original red hue testing on the high-speed oval at GM's Milford Proving Ground, was built using the 1957 *Corvette SS* test mule chassis.

▶ The 1959 *Sting Ray* racer was conceived by legendary GM Design leader Bill Mitchell, who had succeeded Harley Earl in 1958. This was a successful race car and the design inspiration for the second-generation production Corvette introduced in 1963.

at GM Styling Staff, led by Bob McLean. Mitchell revived the Q Corvette's design and tasked Larry Shinoda with turning it into a body for the mule chassis. Shinoda's design, created with assistance from Chuck Pohlmann, went to the GM Styling fabrication shop in the winter of 1958, where it was hand-built from fiberglass with underlying aluminum supports.

Incorporating lessons learned from the *SS* racer, the designers paid particular attention to the *Sting Ray* racer's airflow management. The front grille directed its air to a large Harrison aluminum radiator and most of the air passing through the radiator was channeled over the engine and exhaust headers to keep the engine compartment from getting too hot. Twin vents on the hood allowed air to escape the engine bay, helping keep it cool and eliminating pressure buildup that would cause lift. Ducts on either side of the front grille fed cool outside air to the engine's Rochester mechanical fuel-injection system and front brakes, while ducts atop the rear deck fed cooling air to the inboard rear brakes.

Mitchell went on to successfully campaign the *Sting Ray* in 1959 and 1960 with drivers John Fitch and Dr. Dick Thompson. Larry Shinoda, along with Chevrolet technicians Eddie Zalucki and Dean Bedford, wrenched on the car, albeit as employees of Mitchell since Chevrolet was officially out of racing. In 1960 GM stylist R. Ken Eschebach became the lead mechanic.

Though hampered by erratic brake performance, the limitations inherent in a drum system, and lift rather than downforce from its body shape, the *Sting Ray* ultimately proved quite competitive in modified class competition against Scarabs, Lister-Jaguars, Cunninghams, Allards, and other sports racers. The car got a complete rebuild after the 1959 season, including a new, lighter fiberglass body with panels measuring only 0.060 inch (0.1524 centimeter) thick, which brought its weight down to 2,000 pounds (907.18 kilograms). It also got a new brake system that replaced the troublesome dual-booster setup with a single Bendix Hydrovac unit, modified to allow for quick front/rear pressure adjustment.

Throughout the 1960 season, Thompson thrilled spectators all across America with his at-the-limit driving style that put him right at the razor's edge of the car's capabilities in every corner of every lap. Thompson's exploits earned him the SCCA C-Modified national championship.

Following the 1960 season, the *Sting Ray* went back to Chevrolet, where it was turned into a show car, making its debut at the February 1961 Chicago Auto Show. Today the *Sting Ray* proudly resides in the GM Heritage Collection.

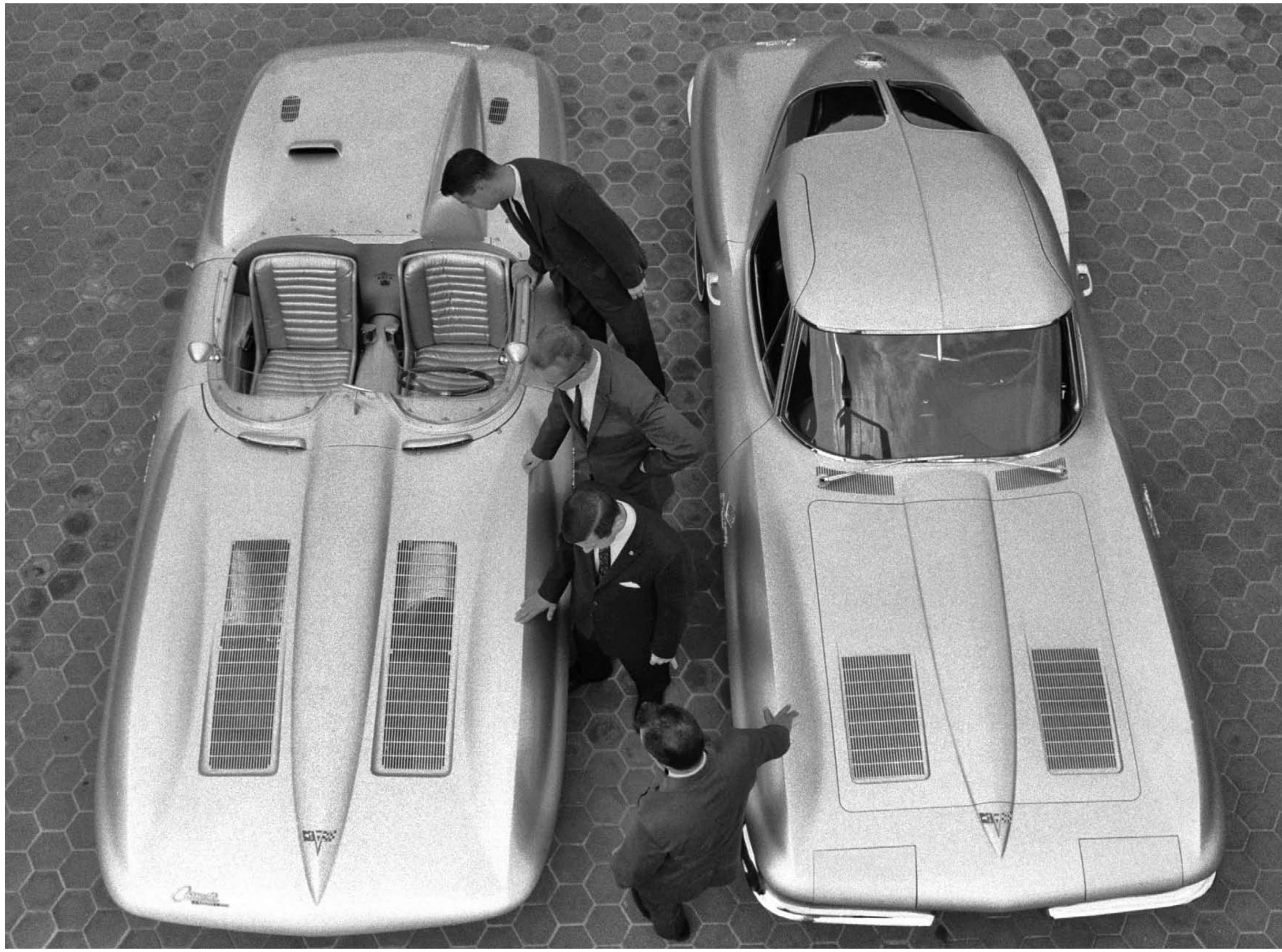
CERV I

Early in his training as an engineer, Zora Duntov concluded that the optimum placement for a high-performance car's engine was in the middle, just ahead of the rear axle. Midship placement of the engine benefited weight distribution, driver visibility, cockpit heat control, and aerodynamic efficiency. His belief in the advantages of this configuration was undoubtedly strengthened by his exposure to pioneering mid-engine cars, including the prewar Auto Union grand prix racers he had seen compete in Germany and the 550 Porsches he had raced to 1.1-liter class victories at Le Mans in 1954 and 1955.

Though Duntov began pushing Chevrolet to produce a mid-engine Corvette in the 1950s, the immense development and tooling costs required made it virtually impossible. His efforts did, however, result in a number of mid-engine styling and engineering specials, beginning with *CERV I* in 1959. *CERV* stands for Chevrolet Experimental Research Vehicle, and that's exactly what this remarkable car served as: a laboratory for the development of lightweight materials and advanced powertrains, aerodynamic concepts, suspensions, and braking systems.

The elegantly slender *CERV I* body was designed by Larry Shinoda and Tony Lapine. Though they were working under design studio head Ed Wayne, it was really Duntov who oversaw the process. The fruit of their labors was a car that slipped through the wind with minimal effort while still generating considerable downforce. Crafted from only two thin layers of fiberglass, the entire body tipped the scales at a mere 80 pounds (36.29 kilograms).

CERV I's chassis was fabricated with thin-wall tubular chrome-molybdenum steel and featured fully independent suspension front and rear with coil-over shocks at all four corners. In a harbinger of what was to come with the second-generation Corvette to be introduced in 1963, the car's rear suspension used the axle shafts as upper links and forged strut rods as lower links. The rear hub carriers, as well at the inboard rear brake drums, were crafted from aluminum to minimize weight.



▲ Production C2 exterior styling is remarkably faithful to that of the 1959 *Sting Ray* racer.

◀ Reportedly using his own money, Bill Mitchell privately campaigned the *Sting Ray* racer in 1959 and 1960, with Dick Thompson driving it to the SCCA C-Modified national championship in 1960.

▶ A press release issued when CERV I was unveiled during the United States Grand Prix at Riverside Raceway in November 1960 called it "a research tool for Chevrolet's continuous investigations into automotive ride and handling phenomena under the most realistic conditions."

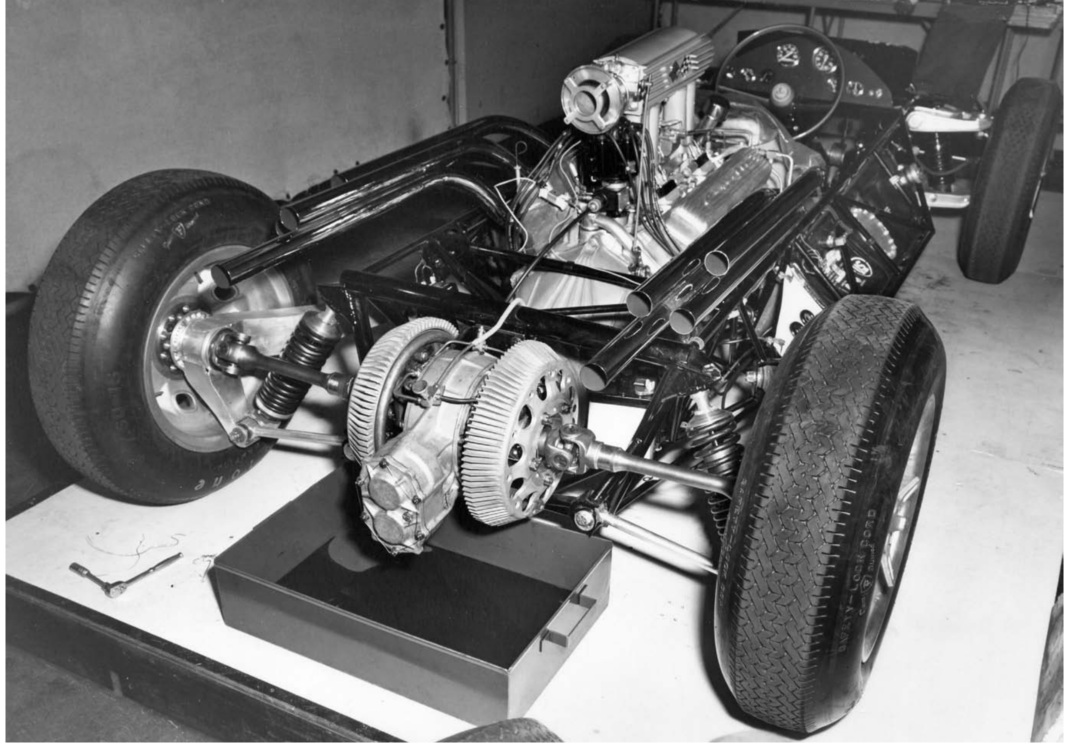
▶ Corvette Chief Engineer Zora Duntov, seen here on the Milford Proving Ground's high-speed oval, was the driving force behind the creation of *CERV I*, a mid-engine research and development car.

▶▶ *CERV I* served as an effective laboratory for the development of lightweight materials and advanced powertrains, aerodynamic concepts, suspensions, and braking systems that influenced future GM production vehicles, including Corvette.

Though many engines were tested in the car over time, *CERV I* was initially powered by a V-8 resembling the 283-cubic-inch (4,367.54cc), 290-horsepower fuel-injected engines available in 1960 production Corvettes, but with a number of significant differences. The experimental car's powerplant used a high-silicone alloy block that weighed 90 pounds (40.82 kilograms) less than the cast-iron version. Aluminum was also employed for the cylinder heads, water pump, starter motor, flywheel, and clutch pressure plate, and magnesium was used for the bell housing and intake manifold. Use of these alloys saved almost 200 pounds (90.72 kilograms), resulting in a complete engine that weighed only 350 pounds (158.76 kilograms). A modified fuel-injection system, featuring an elevated air intake and lengthened ram tubes, as well as individual exhaust pipes for each cylinder, significantly improved the engine's breathing and contributed to its output of 353 horsepower.

CERV I's center-rear-mounted V-8 was coupled to a Borg-Warner T-10 four-speed. The gearbox was nearly identical to the units used in production Corvettes, except it mated directly to a Halibrand quick-change differential.

Though it never raced because of GM's adherence to the 1957 AMA competition ban, *CERV I* did run on numerous tracks, including Continental Divide, Riverside, and Daytona, in addition to the high-speed circuit at GM's Milford Proving Ground. Undoubtedly it would have been a competitive Indy Car or Formula One contender. That aside, it did serve its stated purpose admirably, allowing Duntov and other Chevrolet engineers to test innovative aerodynamic, suspension, steering, braking, and powertrain systems. It helped advance the performance, efficiency, and safety of many vehicles to come, including production Corvettes.



▲ Many interesting features are evident in this view of *CERV I* without its upper bodywork, including axle shafts serving as upper lateral suspension links, inboard rear brakes with aluminum drums, Halibrand quick-change differential, magnesium bell housing, small-diameter tubular space frame, and aluminum engine wearing an unusually tall fuel-injection manifold designed to increase midrange torque.

▲ The body for *CERV I*, made from two thin layers of fiberglass and weighing only 80 pounds, was designed by Larry Shinoda and Tony Lapine with careful consideration for its aerodynamic performance.

▶ In its role as a development car, *CERV I* was driven everywhere from Daytona to Riverside, and even Pikes Peak, often with Zora Duntov at the wheel.

6

BIRTH OF AN ICON

C2 INTRODUCTION, 1963

Corvette was saved from certain death by the installation of Chevrolet's V-8 engine in 1955, and further strengthened by styling changes and significant advances in quality, comfort, and performance introduced in 1956. The focus on performance, in particular, and the nascent efforts to develop Corvette into a successful road racer, gave the car personality and led to dramatic sales increases. In 1956 the increasing sales resulting from improvements to the car—and to the ways Chevrolet marketed it—induced GM to begin thinking about a comprehensive redesign for Corvette.

◀ Compared to 1962, Corvette production increased almost 50 percent when the C2 was introduced in 1963, for a total of 21,513 cars.

C2 CHASSIS AND POWERTRAIN

On the engineering side, Zora Duntov knew that a mid-engine layout would optimize performance, but he faced a major obstacle in getting such a design into production: the transaxle. In 1957 GM did not have a transaxle in production, and it was not willing to commit to the substantial development and tool costs to create one for a low-volume car model. There was hope, however, in the form of GM's secretive Q Car program, launched in the fall of 1957, which was slated to bring an advanced transaxle with both automatic and manual gearboxes to production in a new line of full-size, V-8–powered passenger cars for 1960.

Beyond mid-rear engine placement, Duntov had a wide array of additional ideas for the new Corvette. He was an ardent proponent of four-wheel drive, tubular space frames, monocoque construction, and a host of other performance-enhancing concepts that were very advanced in the 1950s. But their high cost meant that none of these exotic features would be incorporated into the second-generation Corvette. Further exacerbating the always-present financial constraints, toward the end of 1957 dark clouds were forming over the U.S. economy. By early 1958 it was clear that the entire world was facing a significant economic recession. This no doubt played a role in GM's decision to cancel the Q Car program, eliminating all hope for the technologically advanced mid-engine Corvette Duntov envisioned.

Once it became apparent that the next-generation Corvette, known within the company as *XP-720*, would retain a front-engine layout, Duntov focused on making it as good as it could be. The basic designs for C1's short-arm/long-arm independent front suspension and kingpin steering had been created by Maurice Olley for Cadillac in the early 1930s. That car's overall chassis design and solid rear axle were employed by GM even earlier than that, so by the late 1950s there was much room for improvement. Duntov and his colleagues at Chevrolet Research and Development focused on creating a stiffer chassis, improved front suspension and steering, and modern independent rear suspension.

The new chassis was completed in 1961. Duntov was focused on developing *CERV I*, so working out the many details of the production car chassis fell to two of his senior engineers, Walt Zeyte and Harold Krieger. What they produced differed markedly from the first-generation Corvette chassis. It was a ladder design with fully boxed side rails and five cross members. The four forward crossmembers were fully enclosed while the rearmost one was formed from a C-channel.

Duntov and his engineering team paid particular attention to lowering the new car's center of gravity, which would benefit ride quality and handling. To this end they established a ground clearance of 5 inches (12.7 centimeters) and then devised clever ways to get all major masses as close to this clearance line as possible. The entire floorpan, for example, sat between the frame rails rather than on top of them. The spare tire went from a well in the trunk to a carrier mounted at the back of the car beneath the fuel tank. In the end, the new Corvette's center of gravity was 16.5 inches (41.91 centimeters) above the ground. This compared favorably with the first-generation Corvette, which had a center of gravity that was 19.8 inches (50.29 centimeters) from the ground.

The engineers also devoted a lot of thought to weight distribution, with the aim of getting as much mass as was feasible from the front to the rear, where it would provide more balanced handling and greater traction on the drive wheels.

The first Corvettes had a weight distribution of 53 percent front and 47 percent rear, and by 1962, the C1's final year, this had been improved to 51 percent front and 49 percent rear. The second-generation Corvette enjoyed even better weight distribution, with the base car having only 47 percent of the car's mass in the front and 53 percent in the rear. It was particularly important to begin with a rearward weight bias because options such as air conditioning and power steering added considerable weight to the front. Also, over the twenty-year lifespan of the new chassis various other things added more weight to the front, including big-block engines, emissions controls, impact absorbing bumpers, and larger, heavier radiators.

◀ The completely redesigned C2 interior featured a twin-cockpit motif inspired by the aviation industry.

▲ From 1958 to 1977, Bill Mitchell led GM Design and profoundly influenced every one of the more than one hundred million vehicles made under his watch, including Corvettes.

By applying engineering advances such as the rudimentary use of computer-aided design, Duntov's team was able to significantly improve the new chassis stiffness without dramatically adding to its weight. In fact, weight was increased by less than 10 percent while torsional rigidity increased by nearly 50 percent, going from 1,587 to 2,374 lb-ft (2,361.72 to 3,532.90 kilograms per meter) per degree of twist.

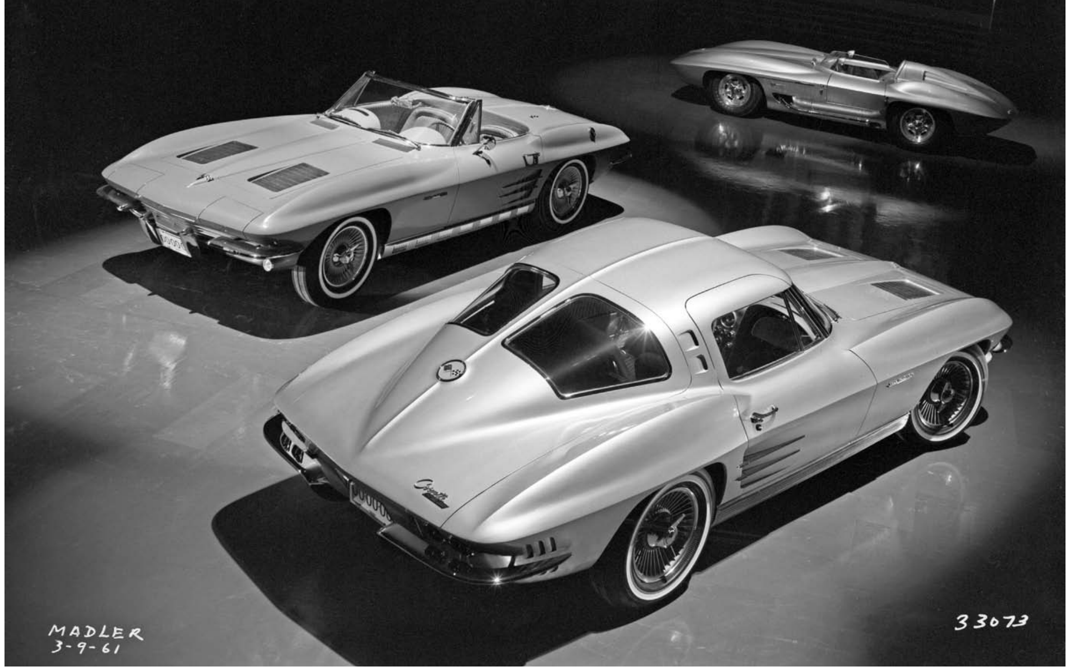
The front suspension was an updated version of Maurice Olley's short-arm/long-arm design, but it used ball joints instead of kingpins and a more direct, precise worm-and-sector steering system. The real news, however, was at C2's back end, with its all-new independent suspension. Trailing arms mounted to the chassis with a single bolt through a rubber bushing at their forward end and shims between the bushing and chassis allowed for toe adjustment. Camber adjustment was accomplished via a bolt with integral cam that mounted the inboard end of an inclined lower link, which consisted of a forged rod extending from the wheel hub to a bracket beneath the differential. A fixed-length tubular shaft with U-joints on either end went from the differential side yokes to the wheel hubs and served as both a lateral stabilizing link and as the driveshafts. A frame-mounted differential, transverse steel leaf spring, and conventional tubular shocks completed the new rear suspension.

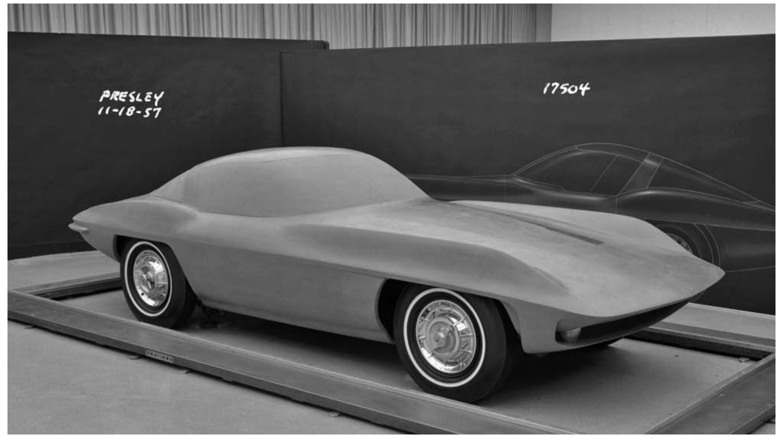
With virtually all of engineering's resources devoted to the new chassis, no significant changes were made to the C2's engine or transmission. The base engine was a 327-cubic-inch (5,358.6cc) V-8 that produced 250 horsepower, with a Borg-Warner three-speed manual serving as the base transmission. Three 327 engines were optional, all the way up to the $430.40 fuel-injected L84, which featured an aggressive solid lifter cam and 11.0:1 compression, offering 360 horsepower. As before, a fully synchronized four-speed manual or two-speed automatic were available at extra cost.

ALL-NEW BODY AND INTERIOR

As with the chassis, Chevrolet's second-generation Corvette was slated to have a completely redesigned body. Harley Earl, head of GM's Styling Section, was still in charge of styling in 1956, when work on the second generation Corvette began, but he would reach GM's mandatory retirement age of 65 on November 22, 1958, so control of the next generation Corvette was turned over to his hand-picked successor, William Leroy "Bill" Mitchell.

Mitchell ranks as one of the most influential automotive designers in history. Earl recruited him to join GM in 1935 after seeing his automotive design work for Barron Collier Advertising and the Automobile Racing Club of America. Within a few months he was appointed chief designer in the





▲ Interesting features on these styling proposals from 1961 that didn't make it to production include louvered rocker trim, door coves, integral wiper grilles, quarter panel vents, quarter panel fuel fill, and opening deck panel.

▶▶ Though GM's Q-Series program was canceled in 1958, the basic elements of the Q Corvette design carried forward to the 1963–1967 production Corvettes, as shown by this full-size clay model of what was called *XP-87*.

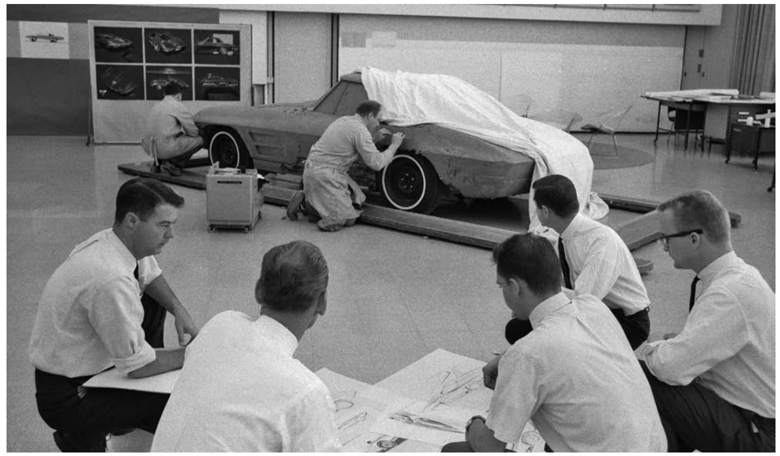
▼ Larry Shinoda, who was intimately involved with designing virtually all production and concept Corvettes made between 1956 and 1968, conducting small-scale aerodynamic testing on 1963 Corvette coupes as well as a Porsche, Ferrari, and Cooper Monaco.

Cadillac design studio. Nearly twenty years later, in 1954, Earl promoted him to director of styling for the entire company and, upon Earl's retirement in December 1958, Mitchell took over as General Motors vice president of the Styling Section. Because styling was still so dominant in the auto industry as a whole, and at GM in particular, that effectively made Mitchell very powerful at GM.

Several cars that Mitchell saw at the Turin Motor Show in May 1957 are thought to have influenced his vision for the new Corvette. These included Abarth race cars, with Giovanni Michelotti–designed alloy bodies fabricated by Boano, and the Alfa Romeo C52 Disco Volantes, with bodies crafted by Milanese coachbuilder Carrozzeria Touring in 1952 and 1953. Chuck Pohlmann, Tony Lapine, Bob Veryzer, Peter Brock, and other GM designers received photos of the Disco Volantes and racing Abarths from Mitchell. With their prominent, sharp-creased bulges above the wheel arches, these cars served to inspire the look of the ill-fated Q Corvette, initially slated for production in 1960.

In 1958, after acquiring the tubular space-frame chassis used for the 1957 *SS* mule, Mitchell revived the Q Corvette's design and tasked Larry Shinoda with turning it into a body for this very capable chassis. Shinoda's design went to the GM Styling fabrication shop in the winter of 1958, where it was hand-built from fiberglass with underlying aluminum supports. Thus was born the *Sting Ray* racer, which Mitchell went on to successfully campaign in 1959 and 1960 with drivers John Fitch and Dr. Dick Thompson.

From April 18, 1959, when the *Sting Ray* racer first appeared in the President's Cup Race at Maryland's Marlboro Motor Raceway, it was a sensation with the public. The bold, beautifully proportioned body also captured the hearts of many at GM Styling, and some of its design elements found their way into C1 Corvettes with the rear body treatment introduced in 1961.



◀◀ In 1961 Dr. Peter Kyropoulos, Kent B. Kelly, and Harry J. "Jud" Holcombe conducted extensive C2 aerodynamic testing using detailed three-eighth scale models in Cal Tech's GALCIT wind tunnel.

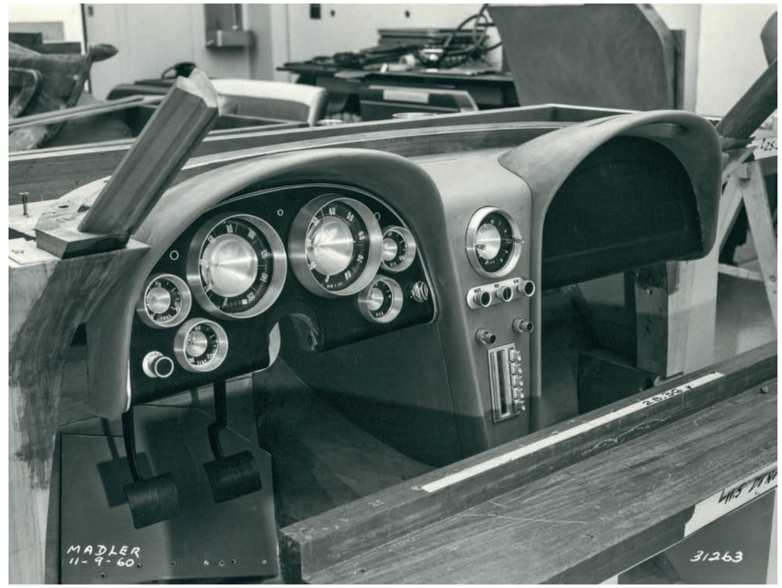
▲ Torsional rigidity of the C2 chassis, manufactured for Chevrolet by A. O. Smith Corporation, was 49.6 percent greater than it was for the C1 chassis, providing an excellent platform for the new upper/lower A-arm, ball-jointed front and fully independent rear suspensions.

▼ By late 1960 C2 design was nearing completion and full-size clay models helped refine the design. When painted and trimmed, these models helped shepherd the car through the executive approval process at GM.

It's not surprising, then, that exterior design of the second-generation Corvette so faithfully followed that of the *Sting Ray* race car. After first crafting a coupe, Larry Shinoda and his colleagues turned their attention to developing a convertible in the fall of 1960. The final design incorporated several noteworthy features, including hideaway headlights and, for the coupe, doors that extended into the roof to increase entry/exit space and the now-iconic split rear window.

As always, the task of turning the designers' vision into reality fell to Chevrolet's engineering staff, with Don Urban leading the small contingent of engineers responsible for the C2 body. Some of the features unique to the C2 presented serious challenges, such as a viable method to secure the outer fiberglass panels to the central body structure, which was made of stamped steel components that had been welded together. At the time, adhesives to bond fiberglass directly to steel didn't exist, so assemblers riveted fiberglass bonding strips to the steel "birdcage" structure and then bonded the outer panels to these strips using polyester-based adhesive.

Another particularly difficult task was engineering the hideaway headlights. The concept was patented by Gordon Buehrig in 1934 and first appeared in the Buehrig-designed 1936 Cord 810, but the Cord's headlamps were manually opened and closed with mechanical linkages connected to crank handles under the dash. GM first used hidden lights in Harley Earl's landmark concept car, the 1938 *Buick Y-Job*. The last company to use hideaway lights in a production car before the 1963 Corvette had been DeSoto, and that was in 1942.



▲ A fully trimmed clay model in this April 15, 1960, shows ideas designers were exploring for the C2 coupe—which didn't make it to production—including quad exhaust tips, smooth front fenders, door cove, and driver-side fuel fill.

▶ This interior styling buck shows that the basic layout of the 1963 dash was established by the end of 1960.

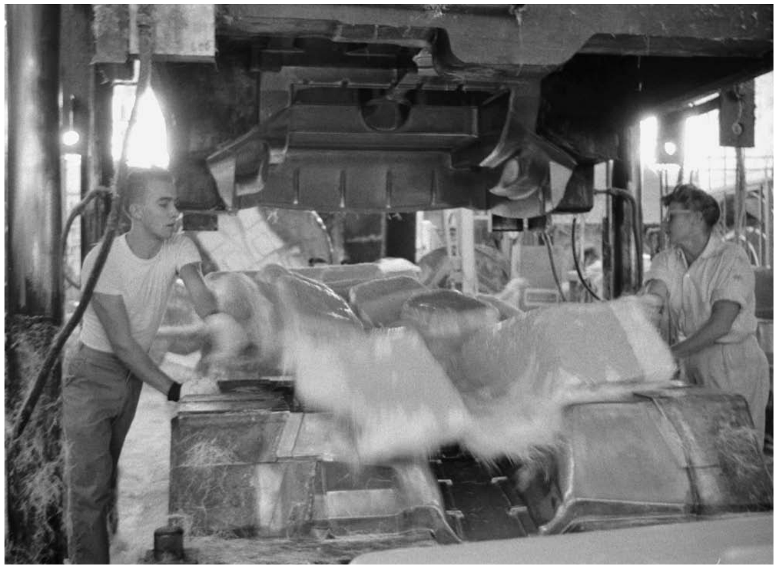
Chevrolet body engineer Carl Jakust, a Detroit native and World War II B-17 pilot who learned drafting at Cass Technical High School, was tasked with making the C2 Corvette's headlights work properly. Jakust and his team designed and built five different solutions before settling on a system that used small, powerful electric motors with integral gearboxes to rotate the headlamp assemblies via shafts with ball-in-socket pivots.

Appearance was clearly the driving force behind C2 body design, but aerodynamic performance would become an increasingly important feature in years to come. In these early days, aerodynamics were carefully overseen by Dr. Peter Kyropoulos. Having received his BA from the University of Göttingen in Germany and his master's and doctoral degrees at the California Institute of Technology, Dr. Kyropoulos served as the technical director of the GM Design staff from 1957 to 1974, then as an executive engineer on GM's engineering staff until his death in 1975.

Dr. Kyropoulos conducted extensive studies of vehicular aerodynamics in 1961, assisted by two of his GM Design colleagues, Kent B. Kelly and Harry J. "Jud" Holcombe. Using extremely detailed three-eighth-scale models of the C2 Corvette in the Guggenheim Aeronautical Laboratory at the California Institute of Technology (GALCIT) wind tunnel, they studied surface pressures, internal and external flow patterns, drag, and noise characteristics.

Though the designers of the *Sting Ray* racer thought they were creating an inverted airfoil that would generate considerable downforce, they in fact did the opposite, yielding a body that generated lift at high speed. Not surprisingly, Dr. Kyropoulos and his assistants discovered that the C2 suffered from the same lift problem. While the C2's design was largely finished prior to its exhaustive wind tunnel analysis, providing no opportunity to deal with the high-speed lift issue, what the engineers learned would greatly benefit later Corvettes.

As with its chassis and body, the second-generation Corvette got a completely new interior, with an aviation-inspired twin-cockpit layout. The array of large, easy-to-read gauges directly in front of the driver testified to the car's performance pedigree, but the interior was not short of creature comforts. These included a spacious glove box, a central armrest in addition to door-mounted outer armrests, full carpeting, padded dash pads, and reasonably supportive bucket seats.

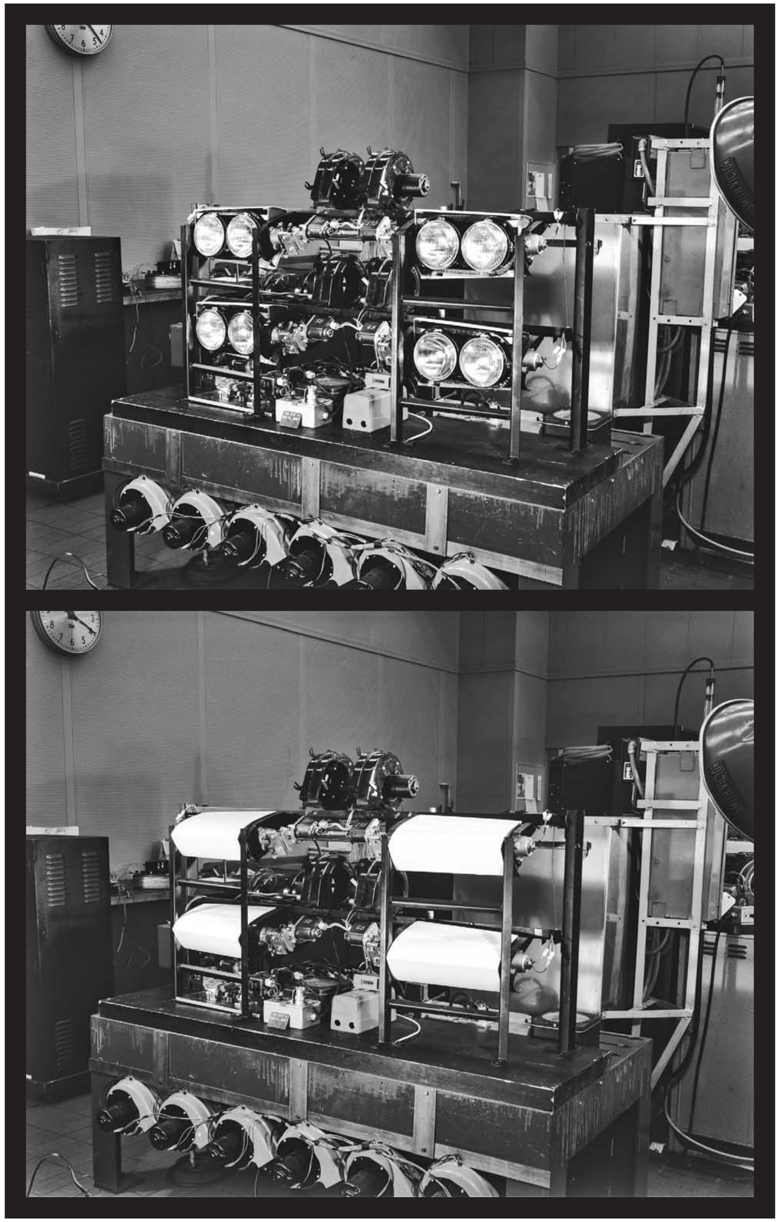


▲ Loosely formed panels saturated with catalyzed resin went into matched male and female metal dies, which were then squeezed together in huge hydraulic presses and heated to accelerate curing of the resin.

◀◀ Manufacturing Corvette body panels was messy and laborious in the 1960s. Chopped fiberglass and a binder spraying out of the machines on either side in this photo were sucked by vacuum onto a wire form in the shape of a C2 floor (which was rotating).

▲ After being removed from their form, loosely formed body panels were saturated with catalyzed resin. At this stage several people worked on large panels, like the floor, before they went into male/female matched-metal dies in huge hydraulic presses.

▼ After coming out of the dies fully formed, cured panels were trimmed along their edges and then shipped to one of the two plants assembling Corvette bodies: the St. Louis Corvette assembly plant or A. O. Smith in Ionia, Michigan, which also made Corvette bodies for Chevrolet from January 1964 through 1967.

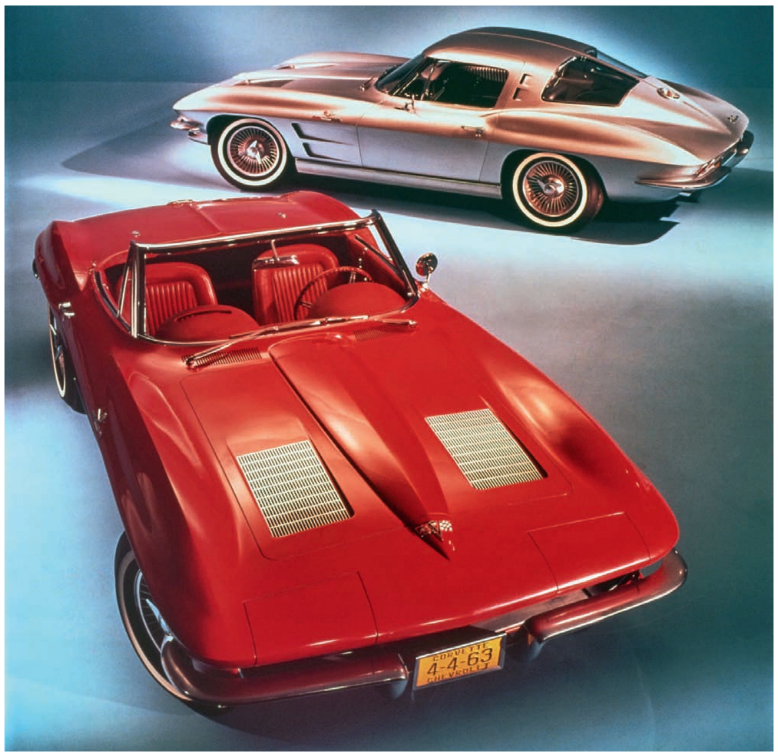


▲ Because they affected safety, C2's rotating headlamps had to be extraordinarily robust and reliable. They underwent rigorous testing on this fixture, which operated twenty-four hours a day and rotated four assemblies up and down thousands of times.

While the performance of first-generation Corvettes could be significantly improved with optional equipment, few luxury amenities were available for these cars. That changed dramatically with the C2. Buyers could still order what amounted to a factory road race car, with a 36.5-gallon fuel tank for endurance events, and the Z06 Special Performance Equipment package that included heavy duty brakes and suspension, Positraction differential, four-speed gearbox, and the 360-horsepower fuel-injection engine. For the first time, though, they could also order a host of comfort and convenience options. Among these were power steering, power brakes, leather seat covers, and air conditioning.

The C2 Corvette's stunning design, exemplary performance, and a long list of options allowing buyers to tailor the car to their wants and needs, all combined to propel sales to a new record. In 1963 Chevrolet sold 10,594 coupes and 10,919 convertibles, for a total of 21,513 Corvettes.

▲ C2 Corvette bodies were hand-assembled and finished, a labor-intensive process that sometimes resulted in erratic fit and finish.



▲ The exterior design for the 1963 coupe, created by Larry Shinoda and his colleagues under the leadership of GM styling boss Bill Mitchell, set a standard that many consider unequaled before or since.

◀◀ C2 marked the debut of two body styles. Production was split almost fifty-fifty, with 10,594 coupes and 10,919 convertibles manufactured in 1963.

◀ Chevrolet produced 199 1963 Corvettes equipped with option Z06, the Special Performance Equipment package, which included a 360-horsepower fuel-injected engine, four-speed manual transmission, Positraction axle, and heavy-duty brake and suspension components.

7

THE C2 MATURES

1964–1967

The all-new 1963 was an instant sensation when it was introduced in the fall of 1962. Though some in the motoring press found fault with its imperfect body fit and finish and less-than-stellar interior quality, demand from the buying public was so high that a second shift had to be added at the St. Louis assembly plant.

◀ All 1965 Corvettes fitted with the optional L78 396 engine got 396 Turbo-Jet fender badges and this hood, with a "power bulge" needed to provide clearance for the big-block's air cleaner.

▲ At the beginning of the chassis line, shown here on September 21, 1965, front and rear suspension parts were installed before the chassis was turned right-side up for engine and drive-train installation.

▶ All C2 Corvettes had to pass a stringent water leak test as they neared the end of the assembly line. If leaks were found, any needed repairs were performed in an adjacent area.

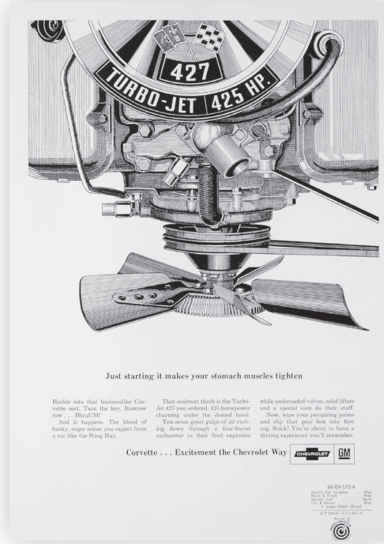
▼ Early installation of a 396-cubic-inch (6,489.28cc) big-block engine in a development car deviates from subsequent production in several ways, including chrome valve covers, overflow tank location, and unpainted radiator.

Changes for 1964 were almost entirely cosmetic, including elimination of the coupe's iconic rear window body split and faux vents in the hood, introduction of a new wheel cover design, and a change from silver to black faces for the instruments. Under the hood, modest improvements led to higher output from the optional high-performance engines, with the solid-lifter, 11.0:1-compression, carbureted L76 327 going from 340 to 365 horsepower, and the fuel-injected L84 327 going from 360 to 375 horsepower.

Corvette's interior benefited from several noteworthy refinements in 1964, all geared toward improving comfort. An electric-fan-powered ventilation system was added to coupes to reduce heat buildup and seat backs got additional padding. The rather delicate shifter used in 1963 was replaced with a stronger one, and buyers could order leather upholstery in any of the available 1964 interior colors, instead of the single saddle option available for 1963.

Though relatively little changed for 1964, the engineers and stylists responsible for Corvette were not resting on their laurels, and a series of important improvements were made in 1965. One of the most noteworthy was the introduction of four-wheel disc brakes. The bespoke system, supplied by Delco Moraine, included large four-piston calipers and radially ventilated discs measuring 11.750 inches (29.845 centimeters) in diameter.

The other big news for 1965 was the introduction of the Mark IV big-block V-8. Priced at only $292.70, which was $245.30 less than the fuel-injected 327, the L78 option displaced 396 cubic inches (6,489.28cc) and delivered an impressive 425 horsepower. The Corvette's 396 big-block lineage can be traced back to Chevrolet's first large-displacement V-8. Called the W-series or Mark I engine, it was introduced in 1958 with a displacement of 348 cubic inches (5,702.7cc), later enlarged to 409 cubic inches (6,702.31cc). The W engines were commercially successful, most notably in Impala Super Sports, as immortalized in the Beach Boys' hit song *409* from 1962. They were also successful in competition, beginning with Junior Johnson's 1960 Daytona 500 victory in a 348-powered 1959 Chevy.



◀ All Corvettes equipped with one of the five different versions of Chevrolet's potent 427-cubic-inch (6,997.28cc) engine offered in 1967 got this unique hood.

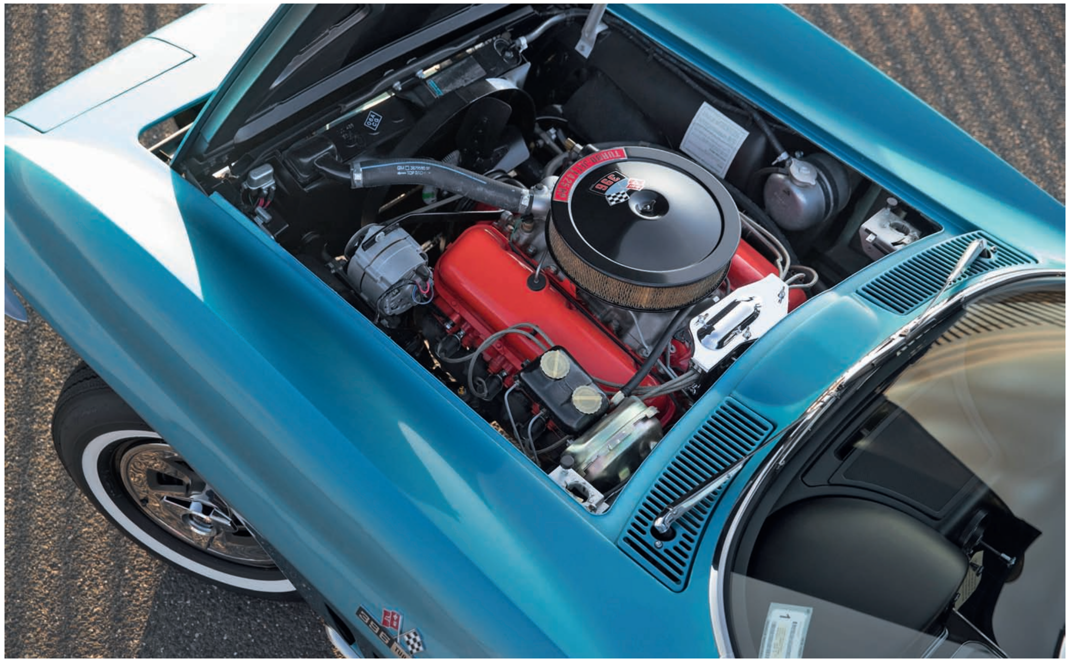
▲ The optional big-block engine was enlarged to 427 cubic inches (6,997.28cc) in 1966, and 5,258 of the 27,720 Corvettes built that year came with it. Output was quoted at 450 horsepower early in production, through approximately serial number 3,000, and 425 horsepower thereafter.

Though winners on and off the track, powerful, economical to produce, and compact enough to fit in the full-size passenger cars of the day, the W-series powerplants did have some weaknesses and limitations that ultimately led to their demise. They were relatively heavy, tended to run somewhat hot, couldn't be enlarged beyond about seven liters, and their exterior dimensions made it impractical to install them into Corvettes or the small and intermediate cars coming down the pipeline, such as Chevy IIs and Camaros. But perhaps most concerning of all, the Chevrolet engineering team eventually hit a wall regarding the W engine's power output.

The way around these inherent shortcomings was a new, clean-sheet design. In mid-1962, shortly after Bunkie Knudsen moved from Pontiac to take the helm as general manager of Chevrolet, he gave Chevrolet chief engineer Harry Barr the go-ahead to design a replacement for the 409 race engine. The team working under Barr, led by brilliant engineer Dick Keinath, went to work in July 1962 to design an all-new engine, which would be called the Mark II.

Aside from a common bore spacing of 4.84 inches (12.29 centimeters) and 409-cubic-inch (6,702.31cc) displacement, the Mark II engine shared nothing else with its predecessor. The new cylinder case was completely square, with the block's deck surface at 90 degrees to the crank centerline and the pistons square to the deck surface. The cylinder heads were completely new as well, with integral combustion chambers and canted valves, which gave rise to the nickname "porcupine" heads. The machining for the valves, as well as all of the related components, was particularly challenging in the era before computer-aided design and tools, but the new head's superior airflow characteristics were well worth the effort required.

The Mark IIS—"S" because it was a 427-cubic inch (6,997.28cc) stroked version of the 409 Mark II—made its racing debut at Daytona in 1963. Unknown to most people, however, the engine's first appearance was not in the Chevy stock cars contesting the Daytona 500. Instead, their very first race was Daytona's American Challenge Cup, a 250-mile (402.34-kilometer)



▲ This beautifully restored 1965 396 engine compartment looks just like it did when new.

▶ Corvette's drum brakes were its weak point in competition until 1965, when a bespoke Delco Moraine four-wheel disc brake system, shown here under development, became standard.

event that included GT cars. Two of Mickey Thompson's Z06 Corvettes entered in that race had been retrofitted with Mark IIS 427 engines by Smokey Yunick. They were the fastest cars on the field, with Junior Johnson driving one to first and Rex White driving the other to second in the event's qualifying race, but poor handling and issues resulting from heavy rain relegated them to third and thirteenth in the 250-miler.

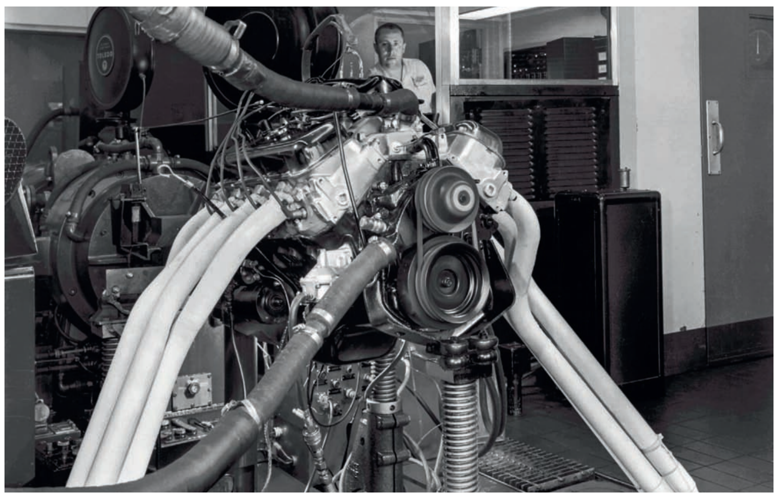
Six days after the American Challenge Cup, Mark IIS-powered Impalas swept the Daytona 500 qualifying races. Junior Johnson won the first 100-mile qualifier in a Ray Fox–entered car at a record-setting average speed of 164.083 miles per hour (264.065 kilometers per hour) and Johnny Rutherford won the second qualifier with an average speed of 162.969 miles per hour (262.273 kilometers per hour). The Mark IIS Impalas were the fastest cars in the Daytona 500, with three of the four leading at some point, but all suffered mechanical problems and bad luck that put them well back at the end.

Owing to GM's publicly stated policy of not racing, going back to June 6, 1957, when the company agreed to the AMA ban on motorsports, Chevrolet had bent over backwards to hide its involvement with the Corvettes and Impalas competing at Daytona. This led the press to call the engine powering these cars the "Mystery Motor." Though the moniker survives to this day, the new engine didn't remain a mystery for long. The cars were so much faster than the competition that everyone wanted to know what was lurking under their hoods, and in short order the existence of an all-new engine was revealed. That, in turn, led to an edict from GM's top management to Chevrolet that anyone caught participating in the mystery motor race engine program would be fired, an order that led understandably to the end of the Mark IIS.

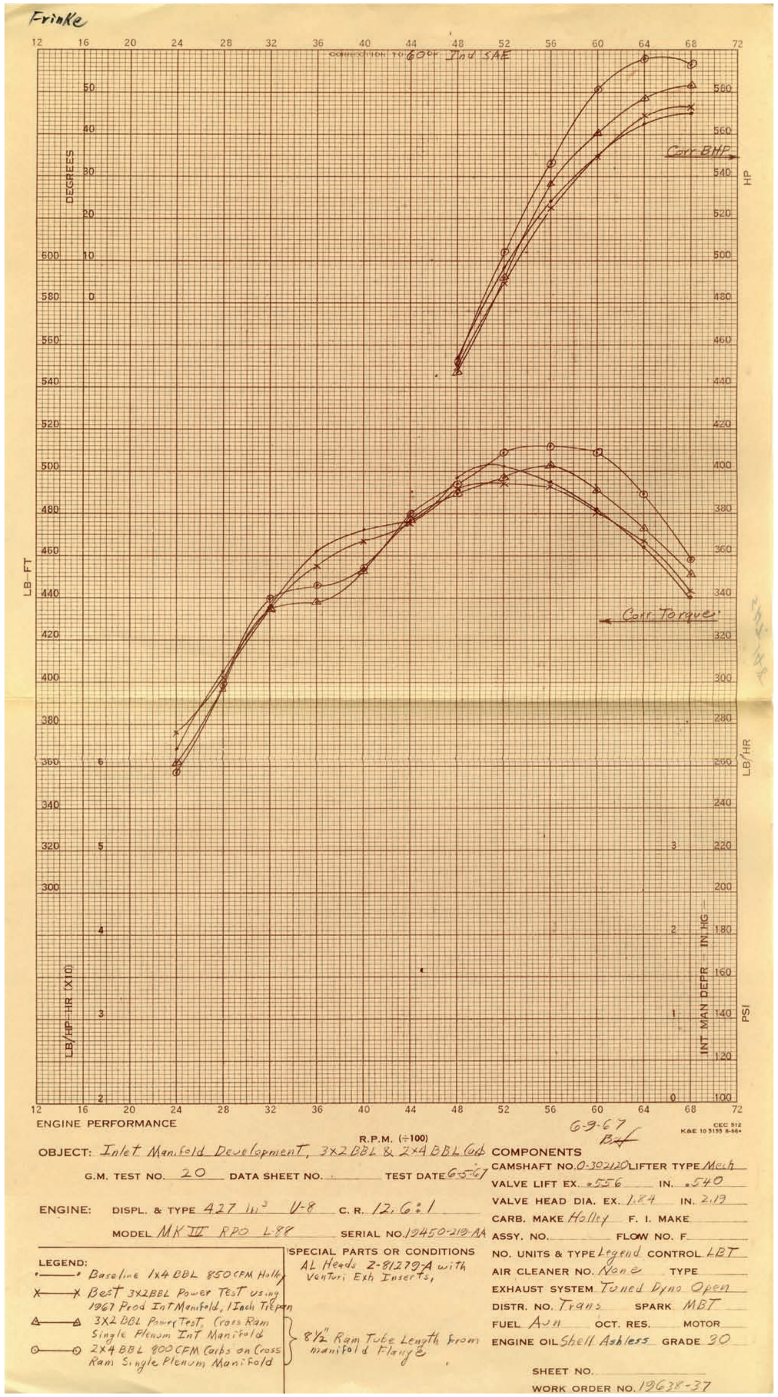
The cessation of Mark IIS production did not, however, mean the end of the big-block engine. Chevrolet had planned on putting a street version of the race mill into passenger cars and trucks from the beginning. In fact, termination of the race program allowed Keinath and some of the other engineers responsible for the Mark IIS to devote all of their attention to designing and developing a new street rendition of the engine.

They began experimenting with a different bore center to allow for a greater bore-to-stroke ratio. The engine, dubbed the Mark III, proved unfeasible for a number of reasons, so they went back to the proven 4.84-inch (12.29-centimeter) spacing. The resulting engine, called the Mark IV, ultimately became the production version. It differed from the Mark IIS in many important ways, including revised intake and exhaust manifolds, additional and repositioned bolt holes, slightly different valve angles, higher tin content in the block and head material, relocated cylinder head ports, and a smaller bore/longer stroke to deliver the same 427-cubic-inch (6,997.28cc) displacement as the Mark IIS.

In 1965 the Mark IV was introduced at a displacement of 396 rather than 427 cubic inches (6,997.28cc) because of GM's self-inflicted prohibition against selling intermediate or smaller cars with engines larger than 400 cubic inches (6,554.83cc). Labeled option L78 for Corvettes, the 396-cubic-inch (6,489.28cc) engine was stuffed full of high-performance parts, including 11.0:1 compression impact-extruded aluminum pistons, forged crankshaft and connecting rods, four-bolt main bearing caps, aggressive solid-lifter camshaft, high-rise aluminum intake, square port cylinder heads, and a 750 cubic-feet-per-minute (21.24 cubic-meter-per-minute) Holley four-barrel carburetor. All of this goodness added up to 425 horsepower at 6,400 rpm and 415 lb-ft (617.588 kilograms per meter) of torque at 4,000 rpm.



◀ The L88 engine option, offered from 1967 to 1969 only, was part of a thinly disguised racing package that turned Corvettes so equipped into formidable competitors.



◀ On June 5, 1967, Chevrolet engineer Fred Frincke dyno-tested an L88 engine with four different induction setups, including a single 850-cubic-feet-per-minute (24.07-cubic-meter-per-minute) Holley four-barrel, which produced 570 horsepower at 6,800 rpm, and two 800-cubic-feet-per-minute (22.65-cubic-meter-per-minute) Holley four-barrels on a cross-ram single-plenum manifold, which produced 596 horsepower at 6,400 rpm.

L78-equipped 1965 Corvettes were distinguished by a special hood with a "power bulge" to provide clearance for the big-block's air cleaner, and 396 Turbo-Jet emblems on each fender. Beginning in 1965, all chassis had a depression in the front crossmember to provide clearance for the big-block's harmonic balancer, regardless of which engine appeared in the car. A number of chassis features were unique to big-block cars, however, including a rear stabilizer bar, larger front stabilizer bar (⅞ inch [2.22 centimeter], versus ¾ inch [1.905 centimeter]), and bolted-on caps to retain the axle's half shafts to the differential.

Under the hood, 1965 396 Corvettes got a larger Harrison aluminum radiator, and the battery was relocated to the driver's side inner wheelwell. The same radiator was also used for 1967–1969 L88 and 1970–1972 ZR1- and ZR2-equipped cars. The relocated battery, which was accessed through a removable door bolted to the inner wheelwell, was used for all 1963–1967 air-conditioned Corvettes, but not with 1966 and 1967 big-block cars.

In 1966 the big-block engine was enlarged to 427 cubic inches (6,997.28cc) and was available in two forms. The L36 had a mild hydraulic camshaft, 10.0:1 compression, two-bolt main bearing caps, and was rated at 390 horsepower. Its sibling, the L72, featured a higher lift and longer duration solid-lifter camshaft, high-rise aluminum intake, forged internals, four-bolt main caps, a 780 cfm Holley four-barrel, and transistor ignition. It was rated at 450 horsepower early in the 1966 model year, and 425 horsepower thereafter, but there was no actual difference between early and late versions. All 1966 Corvettes equipped with a 427-cubic-inch (6,997.28cc) engine had the same power-bulge hood introduced for 1965 396 cars and 427 Turbo-Jet fender emblems.

Buyers of 1967 Corvettes had their choice of seven different engines, the highest number in the marque's history. The same 327/300-horsepower engine made standard in 1966 was again standard in 1967. The solid-lifter, high-compression 375-horsepower fuel-injected and 365-horsepower carbureted engines were discontinued after 1965, but the L79 327-cubic-inch (5,358.57cc), 350-horsepower engine was still available in 1966 and 1967. In addition to the standard 300-horsepower and optional 350-horsepower small-blocks, no fewer than five different big-blocks were offered in 1967. The mildest used 10.0:1 compression pistons, hydraulic camshaft, and a single 585 cubic-feet-per-minute (16.56 cubic-meter-per-minute) Holley four-barrel to produce 390 horsepower. That same engine with a trio of two-barrel Holleys was rated at 400 horsepower. Next up the ladder was option L71, a high-compression, solid-lifter, tri-power engine that yielded 435 horsepower. Option L89 added aluminum cylinder heads to L71 at a cost of $368.65. The power rating remained the same, but the alloy heads shaved some 70 pounds (31.75 kilograms) off the front end.

▶ Chevrolet produced only twenty L88 Corvettes in 1967. This example, special-ordered through Yenko Chevrolet, won GT at Sebring in 1967 and Daytona in 1968.

▶▶ Interior layout stayed the same throughout C2 production, but refinements were introduced each year. The seat upholstery pattern and handbrake handle located between the seats were unique to 1967.

◀ This Nassau Blue 1965 is equipped with optional features that make it highly collectible, including a 396/425-horsepower engine and hardtop.

At the extreme end of the spectrum in 1967, buyers could get engine option L88, which amounted to an all-out racing package. The L88 engine was intentionally underrated at 430 horsepower to discourage all but serious racers in the know from buying it. The L88's steep price of $947.90, plus another $676.40 for the options that were required when L88 was ordered (M22 heavy-duty four-speed, F41 heavy-duty suspension, J50/J56 heavy-duty power brakes, K66 transistor ignition, G41 Positraction, and C48 heater/defroster) also went a long way in dissuading buyers, which helps explain why only twenty L88 Corvettes were produced in 1967.

All 1967 Corvettes equipped with 427 engines got a special hood used for this year only, with a central power bulge painted a contrasting color. When L88 was ordered, this hood was altered to allow fresh air from the high-pressure area at the base of the windshield to flow directly into the carburetor.

Exteriors for 1967 were distinguished from prior years by Rallye-style wheels or optional aluminum "Bolt-On" wheels. New federal safety regulations forced the discontinuation of the various spinner style hubcaps used from 1963 to 1966 and optional aluminum knock-off wheels available from 1964 to 1966. Minor changes to the body for 1967 included elimination of the front-fender crossed-flag emblem and small-block hood emblem, and the substitution of five functional vertical front-fender vents in place of the three functional vertical vents used in 1965 and 1966.

Corvette's interior got a facelift in 1965, with door panels featuring molded-in armrests, new seat upholstery, and revised instruments that had flat, black gauge faces in place of the conical faces used in 1963 and 1964. Minor interior changes made in 1966 and 1967 included different knobs for the radio and HVAC controls, revised seat upholstery patterns, and different seat belt buckles. The interior for 1967 is unique in that the park brake handle was moved to the area between the seats, the rearview mirror got a rubber surround, and, for the first time, a collapsible steering column was added per federal mandate.

SHELL
MARTINI & ROSSI
Gulf

8

KEEPING THE FLAME BURNING

CORVETTE RACING, 1963–1967

◀ The Sunray DX Oil Company's No. 8 L88 Corvette leads a beautifully diverse field at the start of the 1967 12 Hours of Sebring.

Though GM continued its adherence to the June 1957 AMA motorsports prohibition in the 1960s, a small contingent of passionate enthusiasts within Chevrolet's ranks, led by engineer Zora Duntov, continued to find ways around the ban. Well into development of the C2, slated for introduction in model year 1963, they formulated a two-pronged approach to keep Corvettes competitive for owners who chose to put them on track. The first was to make available, as regular production options, various high-performance parts and systems, including a 36.5-gallon fiberglass fuel tank, knock-off aluminum wheels, heavy-duty brakes, heavy-duty suspension, high-output engines, heavy-duty transmissions, and transistor ignition. The second, which was far more ambitious, entailed manufacturing a special variant of the standard Corvette. Though resembling its more mundane counterpart, these ultra-performance Corvettes would have more power, make extensive use of lightweight design and materials, and be devoid of all parts and systems unnecessary for racing, shaving a full 1,000 pounds (453.59 kilograms) from the car's weight. The strict diet led those working on them to call these special Corvettes "Lightweights," but today they are better known as Grand Sports.

ROAD RACE–OPTIONED CORVETTES

Competition-oriented options, first developed for C1 Corvettes from the four-car entry led by John Fitch at Sebring in 1956, continued unabated with C2s. In 1963 199 buyers chose "Special Performance Equipment" option Z06 at a cost of $1,818.45 on top of the car's base price of $4,257.00. All Z06 Corvettes were coupes, and all were fitted with fuel injection, four-speed, Positraction, heavy-duty springs and shocks, a thicker stabilizer bar, and a heavy-duty brake system. Some were also equipped with a 36.5-gallon fuel tank that was initially included with Z06 but later made a separate option.

Four brand-new Z06 coupes made their racing debut in the Times Three-Hour Invitational Race at Riverside Raceway on October 13, 1962. Well-known West Coast racers Dave MacDonald, Jerry Grant, and Bob Bondurant were each "loaned" a Corvette, and land-speed record standout Mickey Thompson got the fourth car for Doug Hooper to drive. Hooper's car ran flawlessly and he won the race, but only because another brand-new car—the considerably faster Shelby Cobra driven by Bill Krause—lost its left rear wheel just past the one-hour mark. Cobras were expensive and largely unsuitable for normal street use, but their thousand-pound (453.59-kilogram) weight advantage made them virtually unbeatable when they didn't jettison a wheel or suffer some other failure. Even so, Z06 Corvettes and their successors still managed to accumulate an impressive record of class wins and championships in the 1960s.

▼ The C2 made its racing debut at Riverside on October 13, 1962, with four brand-new Z06 Corvettes, three of which are seen here on the starting grid as the pre-race drivers' meeting takes place on the track behind them.

The incomparable Dick Guldstrand won Cal Club Pacific Coast championships over three consecutive years beginning in 1963. Jerry Grand and Skip Hudson won GT at Sebring in 1964, Dick Boo teamed with George Robertson to do the same in 1965, George Wintersteen and Ben Moore won there in 1966, and David Morgan and Don Yenko took home Sebring honors in 1967. Don Yenko, Jerry Moore, Ralph Sayler, John Martin, Herb Caplan, Bill Sherwood, George Robertson, Mack Yates, Brad Booker, and Allan Barker were just some of the men who won SCCA divisional championships with Corvettes in the 1960s.

The C2 Corvette's all-out road racing package reached its zenith in 1967 with the introduction of option L88. The heart of the package was a 12.5:1-compression, aluminum-head, 427-cubic-inch (6,997.28cc) engine that delivered 560 horsepower. Several other options were required with the L88 option, including transistor ignition, Positraction, heavy-duty brakes, heavy-duty suspension, and a close-ratio four-speed.

Considering what the L88 package included, what it *did not* include was equally important. Chevrolet would not build an L88 Corvette with air conditioning, a heater and defroster, a radio, a carburetor choke mechanism, a fan shroud, or any emissions control devices. These mandates lightened the cars, but they also discouraged their use on the street.

In case the L88's inability to cold start or its rough idle, ravenous fuel consumption, and total lack of creature comforts were not enough to dissuade street driving, Chevrolet had two more tricks up its sleeve. The first was to intentionally downplay the car's potential with horsepower quoted at only 430, five less than the widely available L71 427-cubic-inch (6,997.28cc) engine. The second was to price it out of the average person's budget. A base 1967 Corvette coupe listed for $4,388.75 and, given the widespread knowledge that an extensively redesigned car was due out in 1968, many 1967s were discounted. In contrast, an L88 topped out at about $6,500 and dealers were generally unwilling to offer any discount. Most dealers didn't even want to get involved in ordering a car that was technically illegal for street use and they therefore required full payment or at least a substantial, nonrefundable deposit up front.

Because the L88 option package included so many unique parts, Chevrolet had to file a Variant Form in accordance with Appendix J of the International Sporting Code to homologate it for competition in any races sanctioned by the Fédération Internationale de l'Automobile (FIA), which included Daytona, Sebring, and Le Mans. The Variant Form was approved, and thus L88 Corvettes were eligible for competition in these prestigious races, beginning January 1, 1967. This paved the way for the most successful of the twenty 1967 L88s sold, the Sunray DX Oil Company's red-white-and-blue coupe.

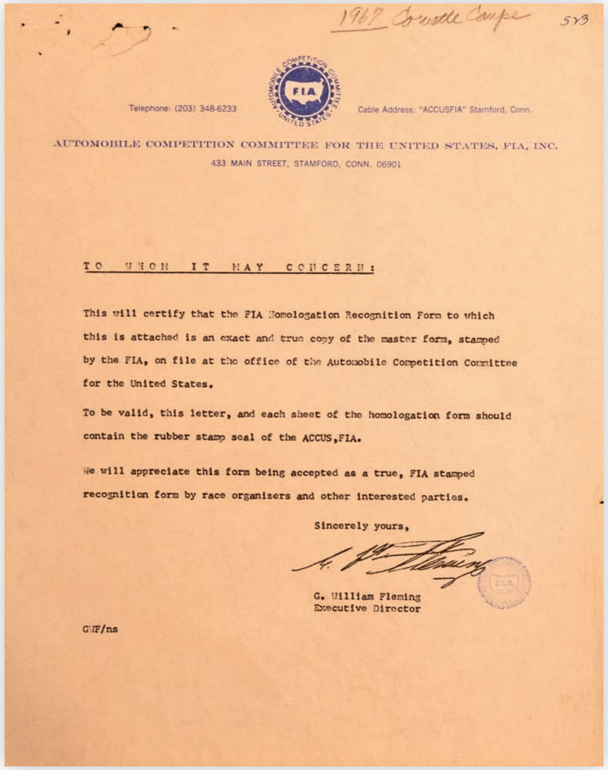
On March 7, 1967, Sunray DX sent well-known midwestern road racer David Morgan to the St. Louis Corvette assembly plant to take delivery of the car. Morgan drove the beast to Yenko Chevrolet in Canonsburg, Pennsylvania, where it was immediately race prepared. A little more than three weeks later the car took its place on the starting grid at the 12 Hours of Sebring.

Morgan and Don Yenko copiloted the car at Sebring, finishing first in the large-displacement GT class and tenth overall despite spending the final forty minutes of the race perched on a sand bank after brake failure going into the hairpin. Morgan campaigned the car solo for the remainder of 1967, taking home the SCCA Midwest Division title for his efforts.

▲ Doug Hooper outlasted the other three Corvettes and several Cobras, and stayed ahead of a hard-charging Porsche RSK, to win C2's maiden race at Riverside on October 13, 1962.

◀ At Sebring in 1963 Dave Morgan and Delmo Johnson drove Delmo's Z06, modified with an oil cooler, aircraft landing lights, a wind deflector, functional hood grilles, and a spare tire in the cockpit, to second in class.

▼ In the 1963 three-hour Daytona Continental, Dick Thompson drove the No. 11 Gulf Oil Z06 to first in class and third overall, behind two Ferrari 250 GTOs.



1967 Corvette Coupe 573

Telephone: (203) 348-6233

Cable Address: "ACCUSFIA" Stamford, Conn.

AUTOMOBILE COMPETITION COMMITTEE FOR THE UNITED STATES, FIA, INC.

433 MAIN STREET, STAMFORD, CONN. 06901

TO WHOM IT MAY CONCERN:

This will certify that the FIA Homologation Recognition Form to which this is attached is an exact and true copy of the master form, stamped by the FIA, on file at the office of the Automobile Competition Committee for the United States.

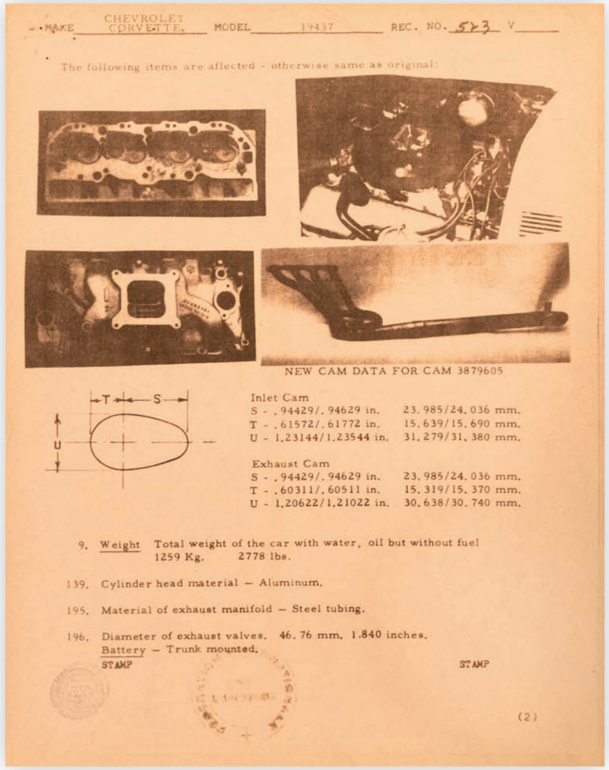
To be valid, this letter, and each sheet of the homologation form should contain the rubber stamp seal of the ACCUS,FIA.

We will appreciate this form being accepted as a true, FIA stamped recognition form by race organizers and other interested parties.

Sincerely yours,

G. William Fleming
Executive Director

GWF/ns



MAKE CHEVROLET CORVETTE. MODEL 19437 REC. NO. 573 V

The following items are affected - otherwise same as original:

NEW CAM DATA FOR CAM 3879605

Inlet Cam
S - .94429/.94629 in. 23.985/24.036 mm.
T - .61572/.61772 in. 15.639/15.690 mm.
U - 1.23144/1.23544 in. 31.279/31.380 mm.

Exhaust Cam
S - .94429/.94629 in. 23.985/24.036 mm.
T - .60311/.60511 in. 15.319/15.370 mm.
U - 1.20622/1.21022 in. 30.638/30.740 mm.

9. Weight Total weight of the car with water, oil but without fuel 1259 Kg. 2778 lbs.

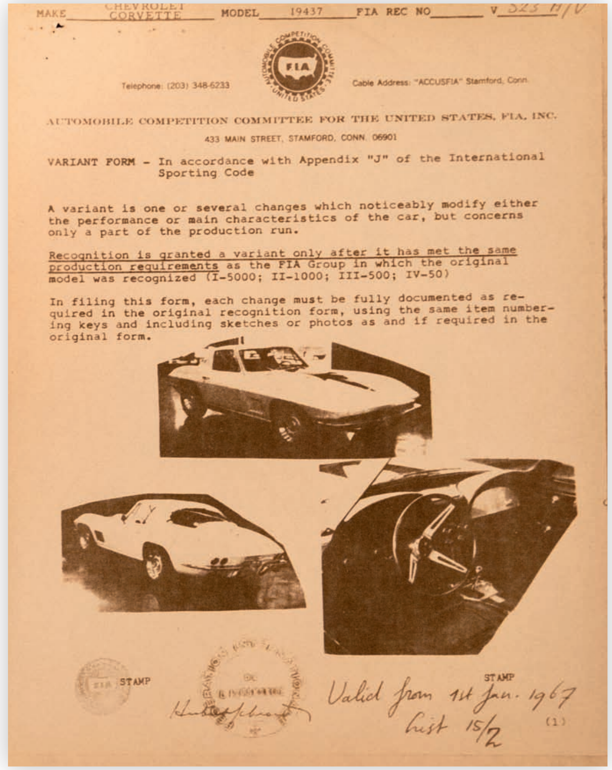
139. Cylinder head material – Aluminum.

195. Material of exhaust manifold – Steel tubing.

196. Diameter of exhaust valves. 46.76 mm. 1.840 inches.
Battery – Trunk mounted.

STAMP STAMP

(2)



MAKE CHEVROLET CORVETTE MODEL 19437 FIA REC NO V 573 H/V

Telephone: (203) 348-6233

Cable Address: "ACCUSFIA" Stamford, Conn.

AUTOMOBILE COMPETITION COMMITTEE FOR THE UNITED STATES, FIA, INC.

433 MAIN STREET, STAMFORD, CONN. 06901

VARIANT FORM – In accordance with Appendix "J" of the International Sporting Code

A variant is one or several changes which noticeably modify either the performance or main characteristics of the car, but concerns only a part of the production run.

Recognition is granted a variant only after it has met the same production requirements as the FIA Group in which the original model was recognized (I-5000; II-1000; III-500; IV-50)

In filing this form, each change must be fully documented as required in the original recognition form, using the same item numbering keys and including sketches or photos as and if required in the original form.

STAMP STAMP

Valid from 1st Jan. 1967

(1)

▲ The Fédération Internationale de l'Automobile (FIA) homologated Chevrolet's L88 engine effective January 1, 1967, so as of that date L88-powered Corvettes were eligible to race at Sebring, Le Mans, Daytona, and other FIA sanctioned events.

▶ The Sunray DX Oil Company's No. 8 Corvette, special-ordered from Yenko Chevrolet with the L88 option package, was driven by Don Yenko and David Morgan to first in the large-displacement GT class at Sebring in 1967.

This car's winning ways continued in 1968, with a list of distinguished drivers that included Bob Bondurant, Dick Guldstrand, and Jerry Grant. The most notable win that year came at the 1968 24 Hours of Daytona, where Morgan and Grant drove their red-white-and-blue Corvette to a first in class, tenth overall finish.

Besides its racing duties, the 1967 Sunray DX L88 was used extensively as a testbed for other Corvettes raced under the DX banner and for retail product development. In the thirty-six states where their products were sold, Sunray's line of Supersport lubricants and high-octane fuel were the most visible result of this ongoing field testing and development work.

CORVETTE GRAND SPORTS

Buoyed by success with getting thinly disguised, all-out road racing option packages approved for regular production Corvettes in spite of the AMA racing ban, Zora Duntov felt emboldened enough to build a limited-production super-Corvette, one that he hoped could win Le Mans and Sebring overall. This was feasible given 1962 revisions to the FIA's World Championship for Manufacturers rules that, in theory at least, made GT cars highly competitive by not limiting their engine displacement.

Duntov handpicked a small engineering and design team that included Walt Zetye, Harold Krieger, and Ashod Torosian, to create the special competition Corvette. Their design would maintain the same basic layout and appearance of 1963 Corvettes, but with every component reconfigured to remove as much weight as possible. A large-diameter tubular chassis offered tremendous rigidity and tipped the scales at only 160 pounds (72.57 kilograms). Everything from the hand-fabricated front A-arms to the rear trailing arms, which had holes drilled in strategic locations, was designed to minimize mass. Every bracket on the chassis, from the engine mounts to the body mounts, was made from the thinnest gauge material attainable and then drilled to further lighten it.

Like its regular production counterpart, the Grand Sport body was crafted from fiberglass, although hand-laid to a thickness of only 0.040 inch (0.101 centimeter). The racer's body was further lightened by crafting its underlying support structure from aluminum rather than steel. Aluminum was also used for the rear axle housing. When completed, the car met the designer's objectives, weighing only 1,900 pounds (861.82 kilograms), more than half a ton less than a standard Corvette.

The first Grand Sport was assembled in November 1962 and shipped south for testing at Sebring, with Dick Thompson and Masten Gregory driving. Further testing was conducted in December at Waterford Hills, north of Detroit. The testing showed the car's great potential. In keeping with FIA homologation requirements, Chevrolet was ramping up to build one hundred Grand Sports by December of 1963. The entire program was put on hold, though, when a January 21, 1963, internal policy letter from GM Chairman and CEO Frederic Donner and GM President and COO John Gordon restated GM's continued adherence to the June 1957 AMA racing ban.

A Chevrolet interorganization letter, covering instructions received at a September 24, 1963, Chevrolet Engineering management staff meeting, states "Plans for 100 lightweight Corvette production for December 1963 are to be cancelled. The program to be submitted for Corporation approval will be . . . 5 lightweight Corvettes to be sold (total). Field test of engines and chassis components to be conducted in these cars."

With corporate approval, the five lightweight Corvettes were completed and put into the hands of private racers, including Illinois Chevrolet dealer Dick Doane, Gulf Oil's Grady Davis, Roger Penske, John Mecom, Jim Hall, and Dallas Chevrolet dealer Delmo Johnson. These men and others campaigned the cars for the next several years, albeit with limited success.

◀ In 1965 Barry Bock set an A Grand Touring speed record of 169.654 miles per hour (273.03 kilometers per hour) on the Bonneville Salt Flats in his 1965 396 Corvette and returned in 1966 with his engine enlarged to 427 cubic inches (6,997.28cc) and fitted with Hilborn fuel injection to set a record of 180.138 miles per hour (289.90 kilometers per hour).

▼ Don Yenko leads a hard-charging Cobra and a gaggle of Corvettes, including several C1s, in his Gulf Oil Z06 at Watkins Glen.

▶ This Dana Chevrolet–entered 1967 Corvette, driven by Bob Bondurant and Dick Guldstrand, led its class at Le Mans until its engine expired just before the 12-hour mark.

▶▶ When John Mecom's immaculately prepared Grand Sports arrived in the Bahamas for Nassau Speed Week on November 30, 1963, nobody was more interested in what made them tick than Carroll Shelby.

The Grand Sport's light weight and intensely powerful engines, ranging from Chevrolet-supplied small-blocks to Traco-built 427-cubic-inch (6,997.28cc) big-blocks, made them extremely fast—but the absence of full factory support doomed the cars from the beginning. The most notable successes came at Nassau from 1963 to 1965. In 1963 Penske, Augie Pabst and Dick Thompson swept the first three GT Prototype positions in the Nassau Governor's Trophy race. The following year Penske earned the Grand Sport's only overall win, beating Ken Miles' Cobra in the Nassau Tourist Trophy. Thompson drove his GS to fourth overall and first in GT Prototype at Nassau in 1966.

"Those Lightweights had tremendous potential, but of course GM wouldn't provide any help or let any of the needed parts out for Grady or anyone else," remembered Thompson. "It was very frustrating for all of us." Still, anyone who ever drove a Grand Sport at speed will never forget the experience. "It was the only car I ever drove that would lift the front wheels off the ground in all four gears!" said Delmo Johnson.

Thompson called the 427-powered car he and Dick Guldstrand drove for Penske at Sebring in 1966 "perhaps the fastest car I ever drove, and certainly the fastest car at Sebring that year." The Penske Grand Sport blew by A. J. Foyt's Holman &

◀◀ Dick Thompson recorded the Grand Sport's first race win in the SCCA national event at Watkins Glen on August 24, 1963.

◀ At Sebring in 1964, A. J. Foyt and John Cannon drove the Mecom Racing Team's No. 2 Grand Sport to second in class behind the winning No. 4 Grand Sport of Jim Hall and Roger Penske.

▼ The Corvette corral at Sebring in 1964—Corvettes have had the most passionate and loyal fans since they began racing in the 1950s.

Moody Ford Mark II so quickly that it left Foyt in a state of disbelief. "It went by me like I was stopped!" he later said. By the late 1960s, the Corvette Grand Sports were nothing more than obsolete race cars to most, but thankfully a few visionaries had the foresight to save them from the crusher and all five of them still survive to this day.


Firestone

9

STYLING AND ENGINEERING

SPECIALS OF THE 1960s

Throughout the 1960s, GM remained the largest, wealthiest, and most powerful car maker in the world, and Chevrolet held a firm grip on its position as the company's sales leader. One expression of this dominance was the plethora of styling and engineering specials built during the decade.

◀ GM Design leader Bill Mitchell was as flamboyant as he was creative, and his vision for the third-generation Corvette, as embodied in the *Mako Shark II*, was beautifully proportioned and aggressively bold.

▲ *CERV II* body clay is close to its finished form, but without a fairing behind the driver or air inlets inboard of headlights.

▶ Team members who contributed to the creation of *CERV II* obviously took pride in their work.

▼ Zora Duntov was frequently at the wheel of *CERV II,* which could easily top 200 miles per hour (321.87 kilometers per hour), during its many test laps at various racetracks around the country.

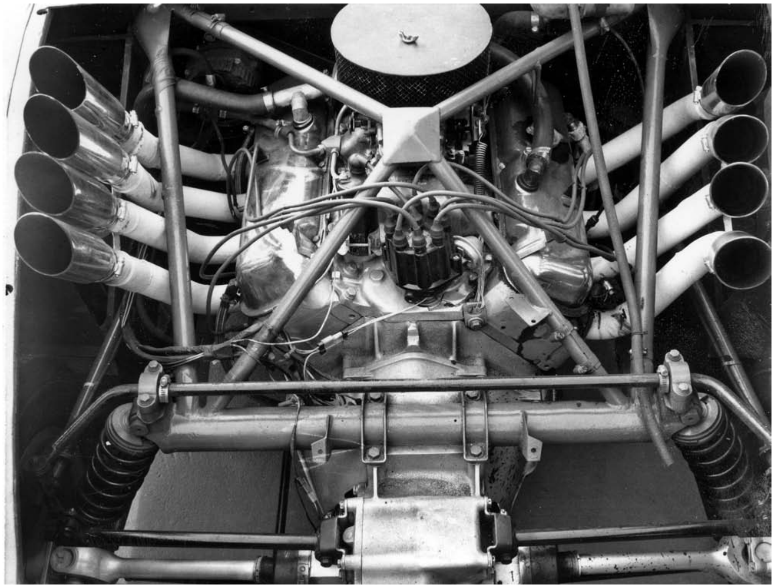
CERV II

Early in 1962, when design and development work on the second-generation production Corvette was in its final stages and design of the Grand Sport was just getting underway, Duntov began another ambitious project. It was a successor to *CERV I*, appropriately called *CERV II*. Like the first *CERV*, it was a research vehicle for testing numerous advanced engineering concepts. In Duntov's mind, however, it could be far more than that.

Semon Emil "Bunkie" Knudsen, who had been promoted to general manager of Chevrolet in 1961, made no secret of his belief in racing as a marketing and development tool. Though management above him didn't agree, Knudsen's support was encouragement enough for Duntov, who designed *CERV II* to compete in endurance races, especially the 24 Hours of Le Mans.

CERV II featured a truss-type chassis crafted from thin-wall steel tubing that weighed only 70 pounds (31.75 kilograms) by itself. The fiberglass body, designed by Tony Lapine and Larry Shinoda, added only 192 pounds (78.02 kilograms). Power initially came from an all-aluminum Hilborn-injected 377-cubic-inch (6,177.92cc) Chevrolet V-8 mounted longitudinally behind the driver. In 1969 an even more powerful aluminum ZL1 427 engine was installed. A compact two-speed transaxle attached to the rear of the engine drove the rear wheels, and a second, nearly identical transaxle mounted ahead of the engine drove the front wheels. Specially calibrated torque converters fed more power to the rear wheels under hard acceleration to take advantage of the naturally occurring weight transfer rearward, offering less power once the car was traveling at high speed. Stopping power came from Girling disc brakes at all four corners and the car rode on 8.5-inch (21.59-centimeter) wide Kelsey Hayes magnesium wheels wrapped in 9.5x15-inch (24.13x38.1-centimeter) Firestone race tires.

Because *CERV II*'s alloy V-8 was mounted at the rear where it couldn't obstruct the driver's view forward, engineers were free to use tall inlet runners tuned to develop maximum power. The engine's mid-rear location also made it easy to



tune the exhaust pipes for peak power. Fully trimmed, the car weighed about 1,625 pounds (737.09 kilograms); with approximately 550 horsepower on tap, it was astoundingly fast. In testing at GM's Milford Proving Ground, Duntov sprinted to 60 miles per hour (96.56 kilometers per hour) from a standing start in 2.8 seconds and recorded a top speed of 214.01 miles per hour (344.41 kilometers per hour).

MAKO SHARK I

The 1961 *Mako Shark I*, also known internally at GM as *XP-755*, was a styling car penned by Larry Shinoda for GM Design Vice President Bill Mitchell. For *Mako Shark I*, which was built using a 1961 Corvette chassis, Shinoda drew on elements from the 1958 *XP-700*, which was a completely functional styling exercise created under the tutelage of Mitchell, as well as the production C2, which was still two years away from its unveiling.

◀ *CERV II* was initially powered by an aluminum 377-cubic-inch (6,177.92cc), Hilborn-injected small-block, but in 1969 it got this considerably more powerful aluminum ZL1 427-cubic-inch (6,997.28cc) engine.

▼ The 1961 *Mako Shark I*, styled largely by Larry Shinoda under Bill Mitchell's leadership, incorporated elements from the 1958 *XP-700* and accurately foreshadowed the C2 introduced in 1963.

▲ *Mako Shark I* was built on a C1 chassis with a body that is clearly based on the 1963 C2 *Stingray,* yet its interior more closely resembles the production C3's interior.

▶ Throughout the 1960s *Mako Shark I* was revised several times and underwent numerous engine and drivetrain updates, ultimately ending up with this potent all-aluminum 1969 ZL1 427 engine.

▶▶ *Mako Shark I* and the second *Mako Shark II* built, shown here, were fully functional styling cars that generated tremendous publicity for Chevrolet, greatly impacting the production Corvettes that followed.

◀ Assembly begins for *Mako Shark I,* built with a newly conceived and fabricated fiberglass body and completely bespoke interior mounted to a production 1961 Corvette chassis.

▼ *Mako Shark I,* still in its initial configuration with a clear double-bubble Plexiglas canopy, doing demonstration laps at Road America.

As its name implies, a mako shark was the driving force guiding the car's appearance. Legend has it that Mitchell caught such a shark while vacationing in Bimini, finding inspiration in its angular snout, aggressive mouth, torpedo-shaped body, and gills. He also reportedly found its coloring stimulating, leading to the show car's unusual blue-and-white paint scheme.

In the years following its debut at the 1962 New York International Automobile Show, *Mako Shark I* underwent numerous changes. Chief among them was elimination of its double-bubble canopy and revisions to its hood and front fascia. It also underwent numerous engine and drivetrain updates, ultimately ending up with an all-aluminum 1969 ZL1 427 engine.

MAKO SHARK II

Though technical advances that would strengthen the role of engineering in the creation of new cars were on the horizon, and increasing government mandates regarding emissions, safety, and fuel economy that would compel engineers to take the lead were also just around the corner, GM's Design Staff still wielded disproportionate influence in the 1960s. This meant that Design Staff leader Bill Mitchell, more than anyone else, determined what Corvette's third generation, initially slated for introduction in 1967, would look like.

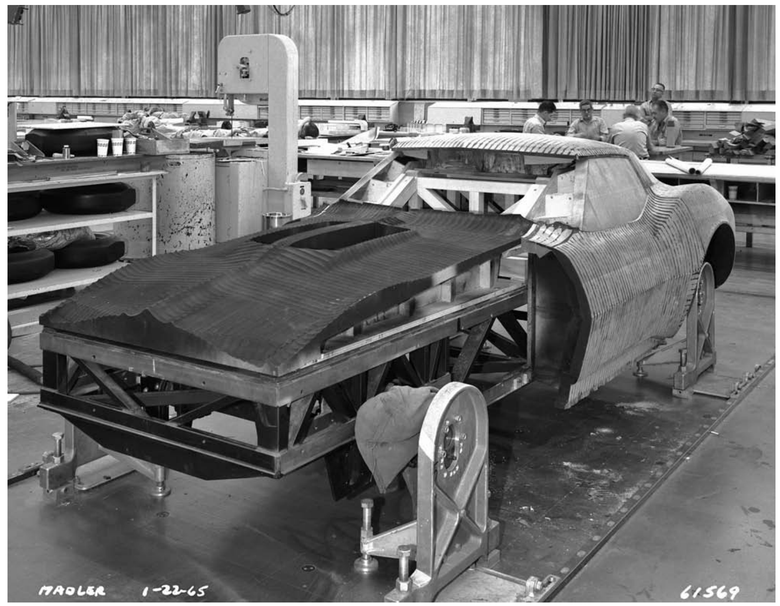
Buoyed by the unprecedented sales success of the C2 *Sting Ray* and infatuated with the *Mako Shark I* show car, he directed his stylists to stretch its proportions and defining characteristics even further. Mitchell was also interested in advanced technology, so he instructed those under him to incorporate a wide array of interesting technical features and gadgetry into this next-generation Corvette show car. The result, unveiled first as a nonfunctional design study at the April 1965 New York International Auto Show, was *Mako Shark II.*

Concurrent with the creation of the display car, a fully functional *Mako Shark II* was being assembled under the supervision of Warren Olson. With a team of expert mechanics and fabricators, including Ken Eschebach and Art Carpenter, Mitchell's new showpiece, penned largely by Larry Shinoda with able assistance from Henry Haga and David Holls, was a tour de force of design extremism and technological prowess. It was longer, lower, and wider than *Mako Shark I*. Its pointed nose, V-shaped windshield, severe fender peaks, outward-bulging wheel arches, taut waistline, slender roof tapering rearward to a point atop the deck, and dramatic ornamentation all combined to create a truly radical car. Predictably, its severity was polarizing, but far more people were enthralled than appalled, cementing this design, albeit toned down considerably, as the next-generation Corvette.

Once viewers got past *Mako Shark II*'s mesmerizing appearance, they were equally surprised and delighted by its functional features. The car's entire nose tilted forward, giving unobstructed access to its beautifully trimmed 427-cubic-inch (6,997.28cc) engine. Its rear bumper and exaggerated

▲ The starting point for the build of the fully functional *Mako Shark II* was a regular production 1965 Corvette, which gave its chassis and floorpan to the effort.

▶ *Mako Shark II* was initially built as a nonfunctional styling exercise for the April 1965 New York Auto Show. Before the showpiece was finished, though, work was already underway on a fully operational version that was built on top of a production 1965 chassis.



▲▲ Aside from the lightly modified production 1965 chassis and fiberglass floorpan, every other part of the *Mako Shark II* styling car, including its entire interior, was designed and fabricated from scratch.

▲ The body buck for the *Mako Shark II* show car was built on a complex wood framework in the GM Styling Fabrication Shop.

◀◀ *Mako Shark II* coming together at GM Design in the summer of 1965. The car's forward-tilting nose was not used for production C3 Corvettes but did find its way into production almost twenty years later for C4.

◀ Though *Mako Shark II* was a styling car, not an engineering exercise, it was full of innovative technical features, including retractable rear bumper and ducktail rear spoilers, and rotating rear license plate mount.

▼ There was nothing subtle about *Mako Shark II*'s provocatively curvaceous body, the rear of which retained clear links to the C2 coupe's rear window and dramatically tapered rear deck.

"ducktail" rear spoilers retracted into the body at the flip of a switch and, as a tip of the hat to Bill Mitchell's love of speed and disdain for speeding tickets, the rear license plate mount rotated to hide the plate. Other advanced features included digital instruments, power door locks and latches, fiber optics monitoring exterior light function, vacuum-controlled variable operating range for the three-speed Turbo Hydra-Matic transmission, three-way adjustable quartz-iodide headlights in electrically retractable housings, a vacuum-servo-actuated flush fuel filler cap, electrically adjustable pedals, and electrically adjustable headrests.

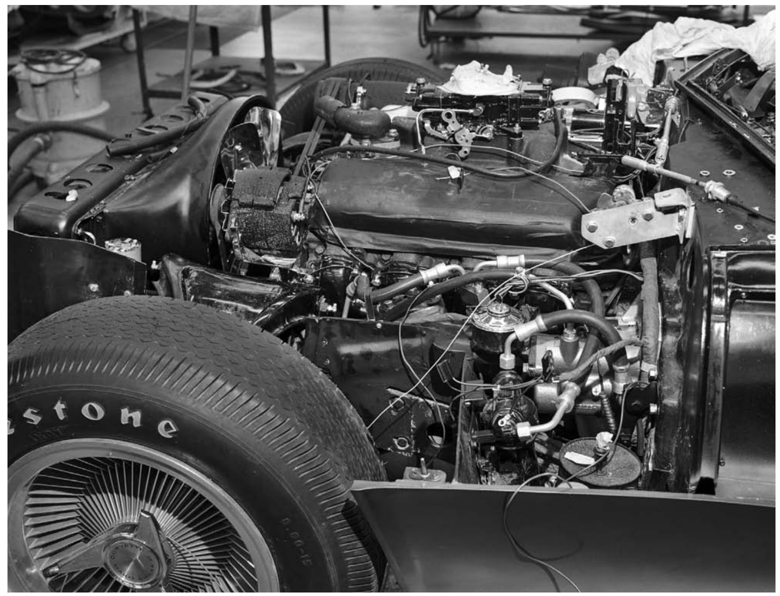
Mako Shark II toured the world for a couple of years and garnered significant attention from the motoring press and public alike. It also served as a pace car for various races, and as Bill Mitchell's personal car through the fall of 1967. By then, the new C3 Corvettes were being delivered to customers: the *Mako Shark II* was suddenly no longer as futuristic as it once seemed. It was then that the car returned to GM's Tech Center for an extensive makeover, which transformed it into a new showpiece called the *Manta Ray.*

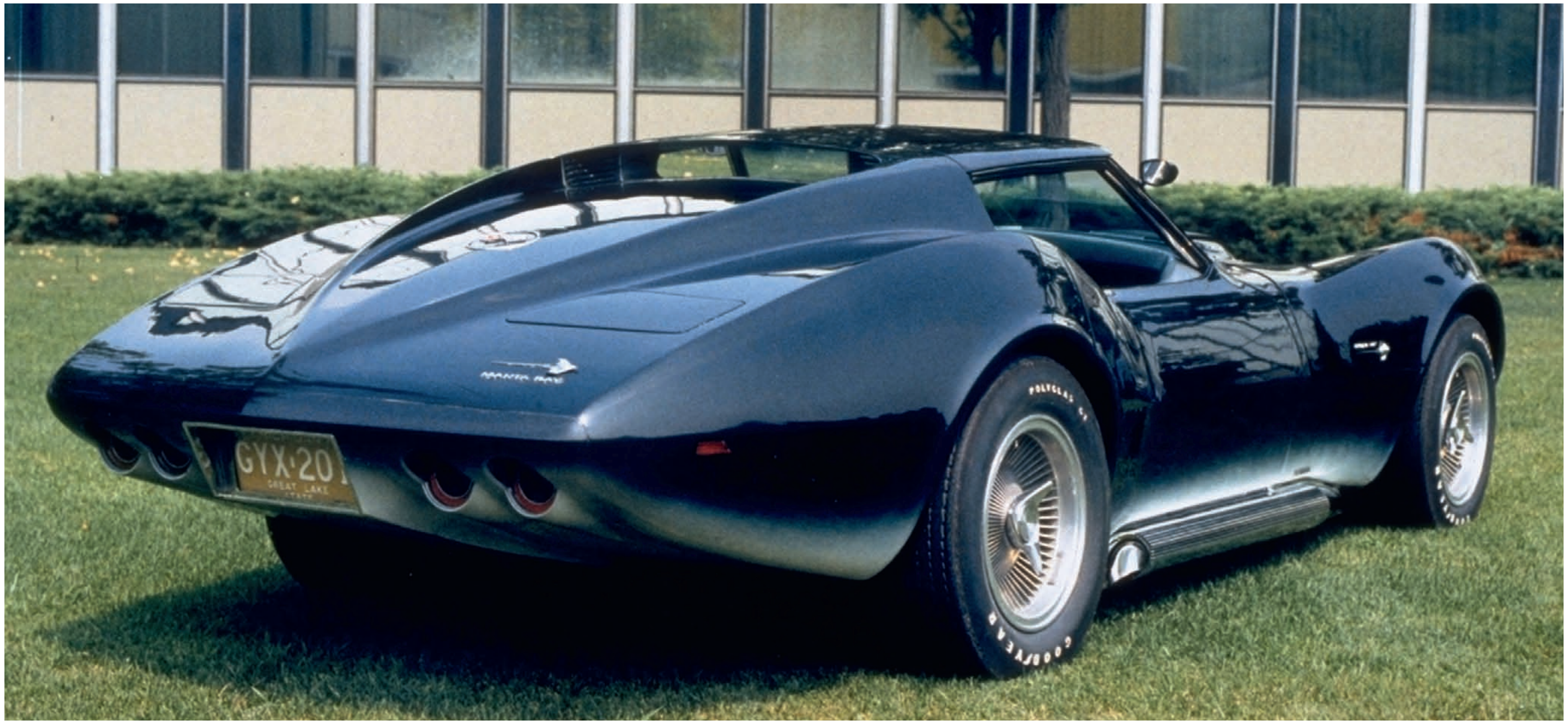
▶ Designers and clay modelers bring *Mako Shark II*'s complex, aggressive body contours to life.

▶▶ Working in the basement at GM Design, technicians used the full-size clay of *Mako Shark II* to make molds that were then used to form the car's fiberglass body panels.

▼ Between its 427-cubic-inch (6,997.28cc) engine, air conditioning, and other usual accessories—along with a bespoke array of special motors, wires, cables, switches, and hydraulics that were not found in production Corvettes—space was at a premium under *Mako Shark II*'s nose.

For the *Manta Ray*, stylists created a new, longer, and dramatically tapered rear end. A long list of other changes, including a rear Endura bumper, new door mirrors, a relocated fuel filler, and the elimination of the rear window louvers, further distinguished the *Manta Ray*. Under the hood, an aluminum 427 ZL1 engine replaced the previously used iron block 427. By 1971 the *Manta Ray* was retired and today resides in GM's Heritage Collection.





◀ (Both) Beginning in late 1967, *Mako Shark II* was extensively restyled, fitted with an aluminum ZL1 427, and renamed *Manta Ray*.

▼ Chevrolet justifiably called *Mako Shark II* “a rolling laboratory for daydreams” in its advertising.


GOODYEAR

10

REVOLUTIONARY STYLING

C3 INTRODUCTION, 1968

Designers and engineers at Chevrolet began working on C3 shortly after C2 made its debut in 1963. As was the case with C2, there were powerful forces working both for and against transitioning to a mid-engine configuration for C3. Leading the charge in favor of the change were engineers Zora Duntov and Frank Winchell. In opposition, they faced Bill Mitchell, who had taken the helm at GM Design following Harley Earl's retirement at the end of 1958. Mitchell strongly favored the traditional sports car proportions that came with front-engine architecture, including a long nose, pushed-back cabin, and short rear overhang. Like his predecessor, Mitchell wielded enormous power, making any effort to overcome his resistance an uphill battle. An even more difficult obstacle was the cost of creating a mid-engine Corvette.

◀ The C3's beautifully aggressive body design was remarkably faithful to the *Mako Shark II* show car.

▶ Larry Shinoda was responsible for the body design of *Astro II,* a beautiful mid-engine concept created by Chevrolet R&D, under the leadership of Frank Winchell, who hoped it would be the C3.

Complicating matters further, though Winchell and Duntov both favored a layout that placed the engine behind the driver, they strongly disagreed with one another on the exact form this should take. Winchell led a team of engineers in the Chevrolet Research and Development Group who completed the design of several mid-/rear-engine experimental Corvettes in the 1960s. The most viable example of their work, called *Astro II* (also called *XP-880*), drew on the group's experience with previous mid-/rear-engine cars, starting with two Corvair-based prototypes that utilized a monocoque designed by engineer Jim Musser. The *Monza* coupe had the Corvair's flat-six engine and transaxle between the driver and rear axle, while the *Monza SS* put the same engine and drivetrain behind the rear axle.

Musser and others working under Winchell also created the 1964 *Grand Sport II* (known initially as *XP-817*), a beautiful experimental car built by Chevrolet and developed in conjunction with Jim Hall's Chaparral Racing operation in Midland, Texas. This car featured a fiberglass body, designed by Larry Shinoda, atop an aluminum monocoque frame.

Chevrolet R&D's next experimental Corvette, called *XP-819*, used an all-aluminum V-8 mounted at the extreme rear. Winchell theorized that the weight savings afforded by the aluminum engine, in concert with rear tires sized suitably wider than the fronts, would deliver good handling characteristics despite the extreme rearward weight bias. While the chassis could be set up to handle well on a skid pad in steady-state cornering, it was horrendous in a real-world environment, where transient maneuvers are required.

Though *XP-819* was deemed an engineering failure, there was no denying the beauty of its body, designed by Shinoda and John Schinella. The influence of both *Mako Shark I* and contemporary Chaparral race cars is evident in *XP-819*'s lines. The car was heavily damaged when Chevrolet engineer Paul Van Valkenburgh crashed it at the Milford Proving Ground and the wreck was, for unknown reasons, sent to famed mechanic and racer Smokey Yunick in Daytona Beach, Florida. The remains of *XP-819* were later purchased by an enthusiast, who restored it, and the car remains in private hands to this day.

Winchell assigned Larry Nies to design *Astro II*'s chassis while Shinoda, who penned both *Monza* prototypes, the production C2 *Sting Rays*, and many other noteworthy vehicles, was responsible for its body. Power came from a 427-cubic-inch (6,997.28cc) big-block mated to a 1963 Pontiac Tempest two-speed transaxle. Most of the suspension pieces were sourced from the production Corvette and Camaro. The widespread adaptation of existing suspension parts, along with use of the Pontiac transaxle, kept *Astro II*'s cost relatively low. The engine, suspension, and drivetrain all mounted to the central steel backbone frame.

While Winchell's R&D group was experimenting with various prototypes, Duntov and the Corvette Engineering Group were progressing with their own designs. In a futile effort to control costs should their creation make it to production, they designed a mostly conventional steel platform-type chassis using existing suspension parts. Chevy stylists, working under Bill Mitchell, penned a rather audacious body for this car in late 1965. Its pointy, wedge-shaped nose and upswept tail drew heavily from the *Mako Shark* show cars, but Shinoda and his colleagues integrated several unique features that set this design apart.

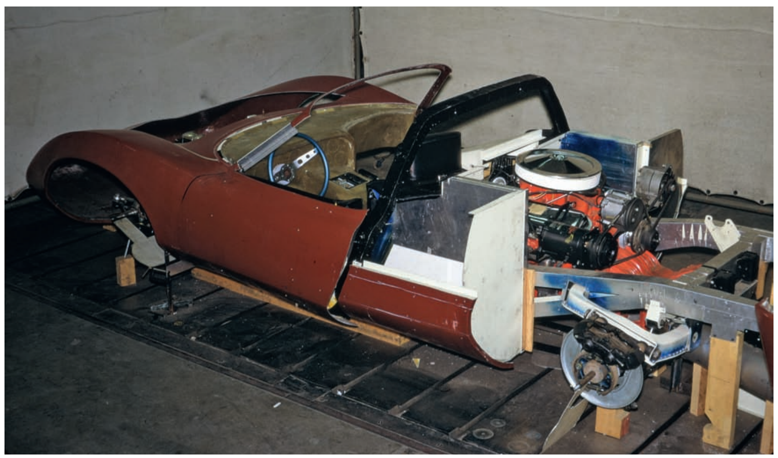
Drawing inspiration from then-current jet fighters, such as the McDonnell Douglas F-4 Phantom II, they designed the rear quarter panels like nacelles, with hinged skirts for the wheels and large air intakes at their leading edges. The windshield was split in the middle, with each half wrapping all the way around to the back of its door. The doors were extremely long, forming part of the front fenders, and each pivoted up complete with its half of the windscreen. This bold design was crafted into a fully trimmed clay mockup. As with all other mid-engine proposals, however, the costs associated with tooling transaxles were insurmountable.

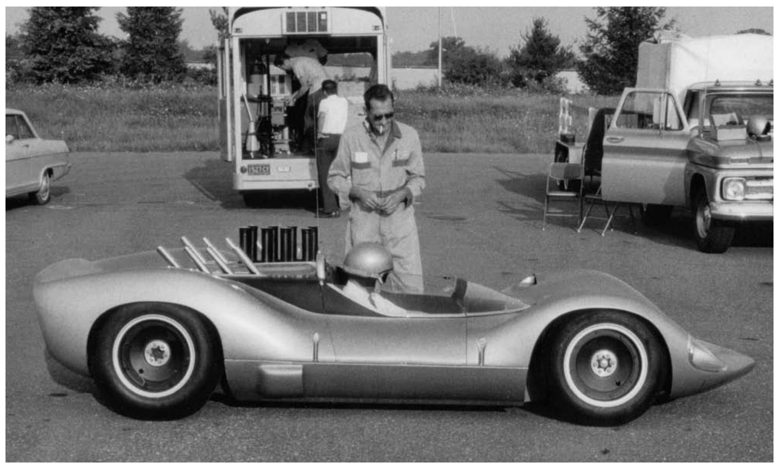
THE C3 TAKES SHAPE

Mitchell knew the tremendous cost of bringing a mid-engine Corvette to production could not be overcome, so concurrent with designing bodies for the mid-engine experimentals, he directed his stylists to produce a more practical proposal for the new Corvette. Shinoda's designs for *Mako Shark II* and the mid-engine cars were turned over to Styling Staff's main Chevrolet studio, then led by David Holls. Under Holls' leadership, a team overseen by Henry Haga turned Shinoda's designs into a production-ready car.

The task was far from easy, and many different ideas were tried, scrapped, or modified before they made the cut. One major challenge was getting good aerodynamic performance from the new body shape. High-speed lift had been a problem with all previous production Corvettes, especially the C2s, which rose approximately 2.25 inches (5.715 centimeters) in the front and 0.5 inch (1.27 centimeters) in the rear at 120 miles per hour (193.12 kilometers per hour).

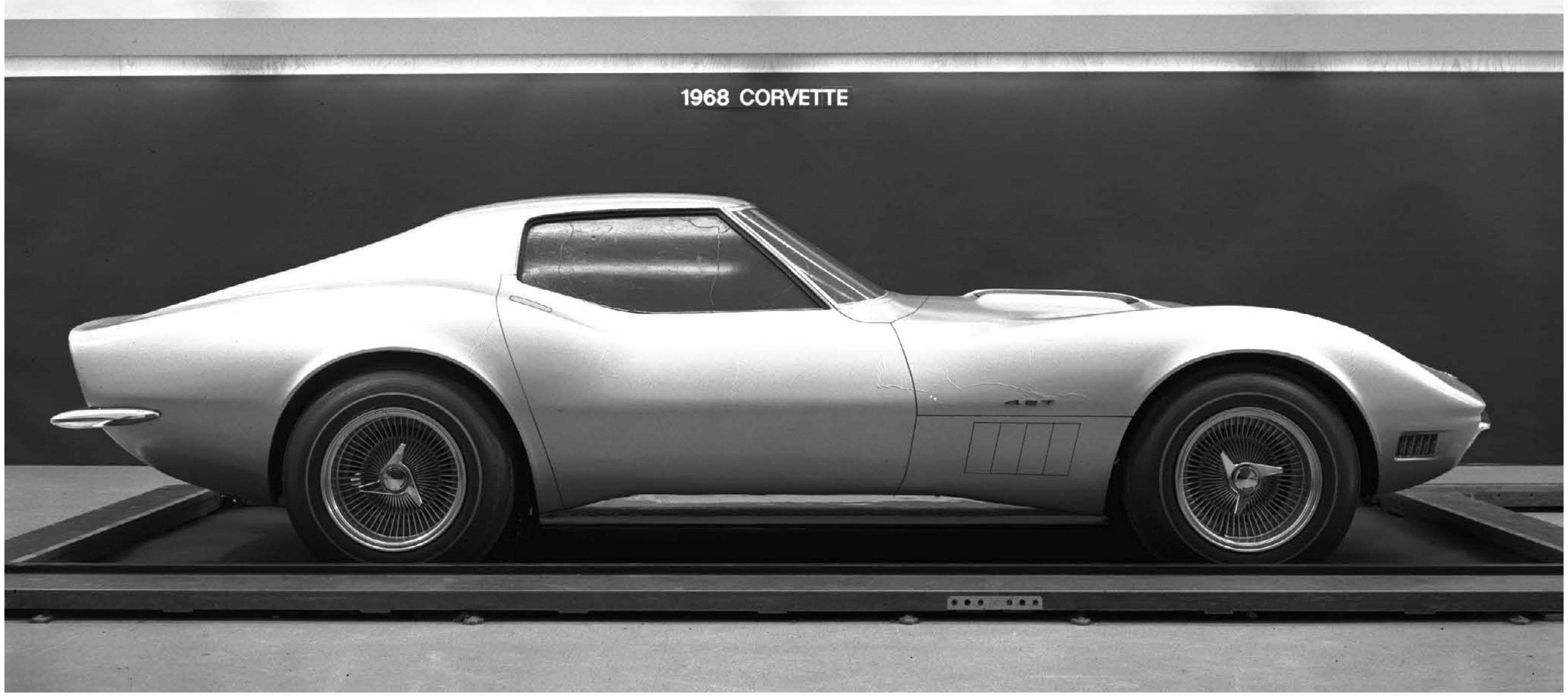
Wind-tunnel and over-the-road testing revealed that the new C3 body design experienced true downforce at the rear, thanks mainly to the upward curve of the rear deck's trailing edge, which effectively gave it an integral spoiler. The front end was a problem, though, since its design produced significant lift all by itself. When the back was pushed down the front rose even more, producing 2.75 inches (6.98 centimeters) of lift at 120 miles per hour (193.12 kilometers per hour). To solve this



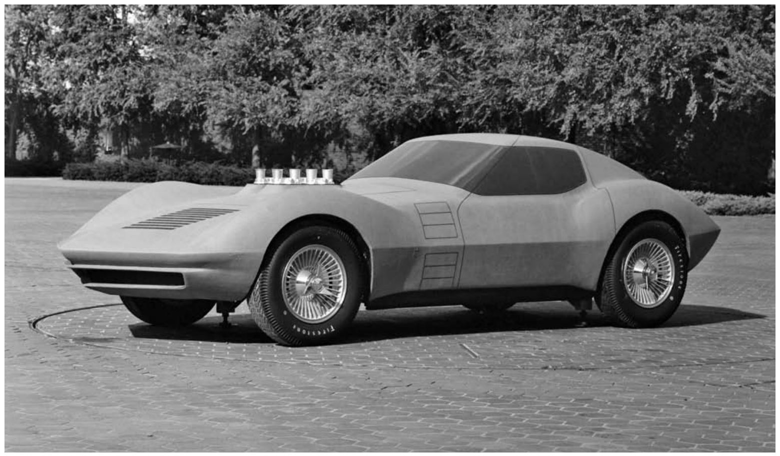


◀◀ Larry Nies led the chassis design team for *Astro II* and hoped the use of a relatively simple steel backbone frame, production 427 engine mated to a Pontiac Tempest transaxle, stock brakes, and mostly stock suspension parts would keep the cost low enough to make this car viable for production as the C3 Corvette.

◀ The 1,490-pound (675.85-kilogram) 1964 *Grand Sport IIB*, designed and built by Chevrolet R&D with an aluminum monocoque chassis and fiberglass body, underwent testing at Jim Hall's facilities in Midland, Texas.



▲ This full-size clay, photographed November 8, 1965, is close to final C3 production but still retains the hood grilles and front marker-light gills used for *Mako Shark II*.



▶ (Both) C3 Corvette design study rendered as a full-size clay resembles *Mako Shark II* with shorter overhangs and a different rear deck treatment.

problem, aerodynamicists added a lower spoiler to the front end and modified the fender vents to more effectively relieve underhood pressure. These two changes brought front-end lift down to an acceptable 5/8 inch (1.59 centimeters) at 120 miles per hour (193.12 kilometers per hour).

Engine cooling was another major aerodynamic challenge with the new body style. Early testing revealed an alarming propensity for the engine to overheat, especially the potent 427s that generated more heat to begin with and filled so much of the engine compartment that air circulation was impeded. The low profile of the car's nose further aggravated the problem by necessitating a relatively severe angle for the radiator, which reduced air passing through it. The overheating problem was mitigated in a number of ways, including installing extra seals around the radiator and its support, adding a front chin spoiler extension, and cutting holes in the area between the chin spoiler and front grilles.

When the sometimes painful process of getting C3's body ready for production was finished, the result was well worth the effort. Though *Mako Shark II*'s fender peaks were lowered noticeably, and the tapered boat-tail roof yielded to a flat deck and, for coupes, a short, vertical rear window and flat

▲ Full-size clay looks halfway between *Mako Shark II* and final C3 production, with fender vent treatment similar to what was introduced in 1970 and door handle recess in quarter panel that resembles the door opening system for C6.

◀ Two C3 design studies, with the one *at left* very close to final production and the other *at right* retaining a *Mako Shark II*–tapered rear deck and 1967-style fender vents.

deck framed by elegantly flowing buttresses extending from an arch at the cockpit's rear, the final C3 body design remained remarkably faithful to the flamboyant showpiece upon which it was based.

In addition to its new body, the C3 Corvette also got a completely new and equally innovative interior. The overall layout was derived from the *Mako Shark II* and, in keeping with the times, it had an aviation-inspired cockpit motif. Several high-tech interior features first seen on the show car ultimately made it to production, including what Chevrolet labeled fiber optics. Very fine, hairlike strands of a flexible, light-transmitting DuPont plastic called Crofon were bundled together by GM's Packard Electric Division to form cables. One of these cables ran from each of the front headlights and park lights, and also from each rear taillight and the license plate light, to small lenses beneath the radio and below the shifter. If the respective light was working, the fiber optic cable transmitted that light right up to the lens on the console, letting the driver know its status.

Though C3's body and interior were new, very little changed beneath the skin. Corvette's third generation used virtually the same chassis and engines employed for C2. The only

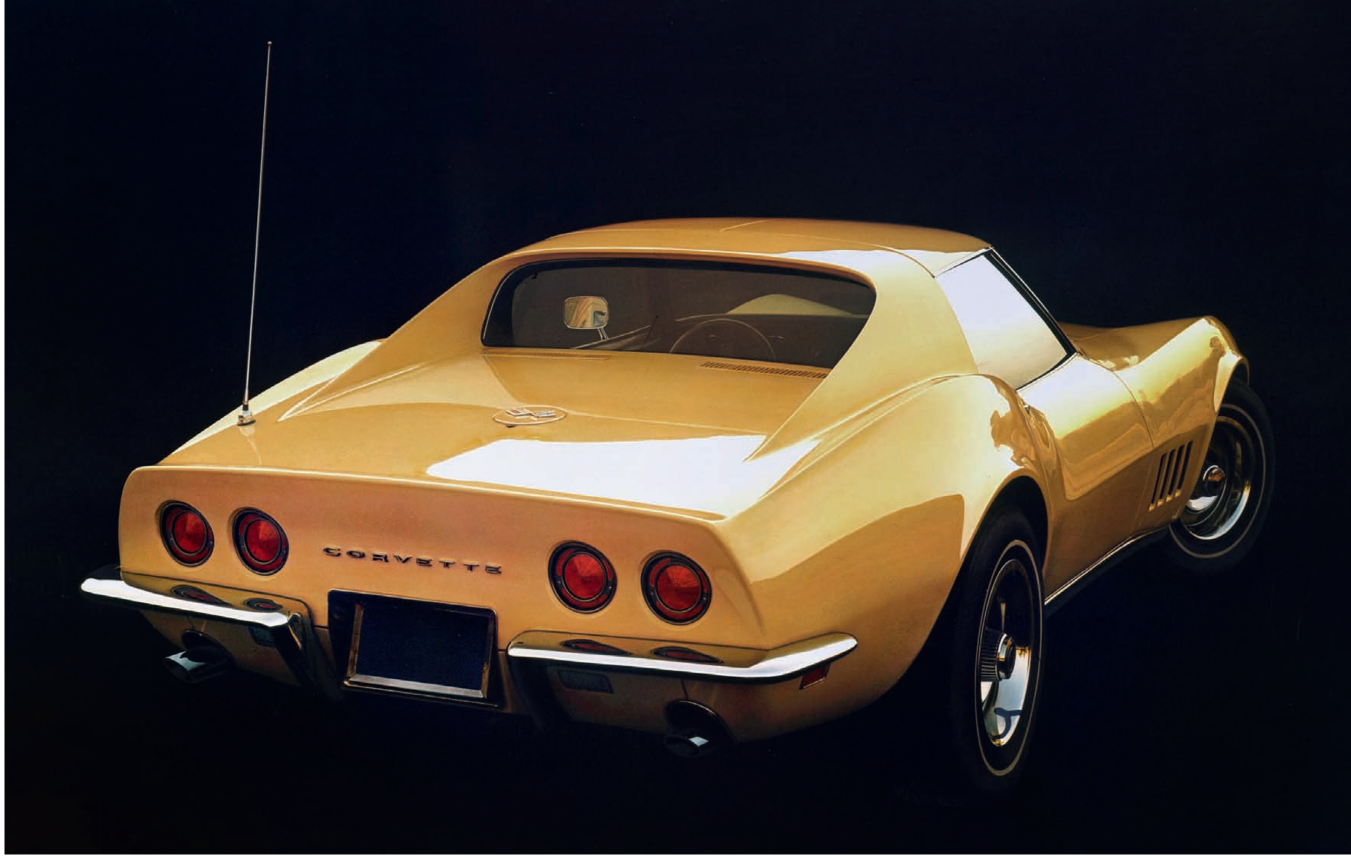
▲ The aircraft-inspired 1968 interior was almost entirely new, with only minor parts, including turn signal stalk, window cranks, steering wheel, shifter, park brake handle, and seat belts, carrying over from 1967 with little or no change.

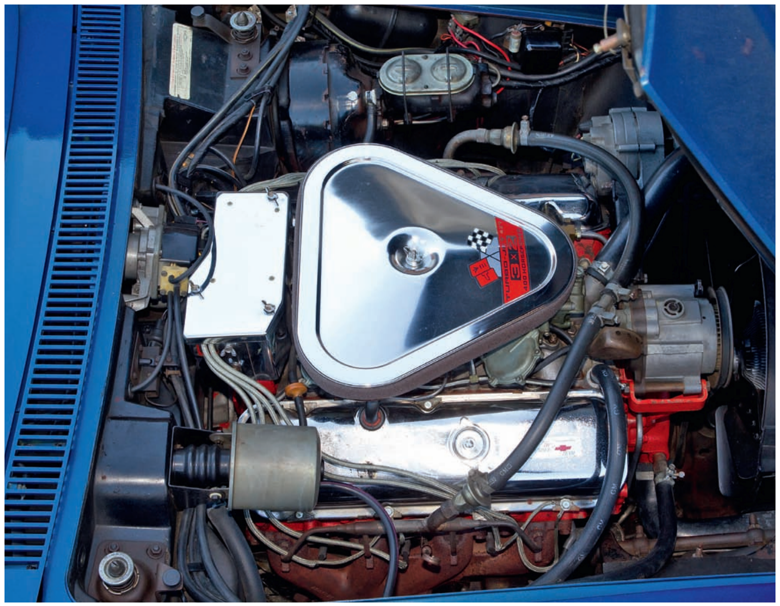
significant change to the chassis was the addition of vertical supports welded between the third crossmember and rear kickups. As in previous years, a 327-cubic-inch (5,358.57cc) V-8 yielding 300 horsepower and three-speed manual gearbox were standard, and six different engines, ranging all the way up to the mighty 427 L88, were available as options. An optional three-speed automatic replaced the previously available two-speed Powerglide.

The volume of things to do delayed the C3's introduction a full model year, making it a 1968 instead of a 1967 as originally planned. Buyers were willing to wait, and Chevrolet managed to make 28,566 of them happy. This was a new production high, eclipsing the previous record of 27,720 Corvettes made in 1966.

▲▲ Early C3 interior design buck, photographed April 26, 1965, shows basic layout of final production with some significant differences, including the configuration of the HVAC module and radio.

▲ February 2, 1967, interior mockup is close to final production.





▲ (Both) Full-size, trimmed clay model, photographed April 22, 1966, is close to final C3 design.

▲ Flying buttress B-pillars are commonly found on a wide array of cars produced over the past six decades, but few look as dramatic and beautiful as they do on a 1968–1977 Corvette.

◀ Engine lineup for 1968 carried over largely unchanged from C2, but additional components, including windshield wiper door actuator and vacuum storage tank, made the C3 engine compartment more crowded, especially in cars equipped with an optional 427.

11

PERFORMANCE PEAK

1969–1972

During the 1960s, state and federal authorities were increasingly involved in various facets of automobile design and engineering. Government agencies initially focused on enhancing safety, but by the early 1970s they were also heavily involved in regulating a wide swath of other aspects of car manufacturing, including emissions, fuel economy, and noise. While the many regulations set by Washington, D.C., and several state governments did make cars safer, cleaner, more efficient, and quieter, there is no denying that many of these same regulations also diminished performance significantly.

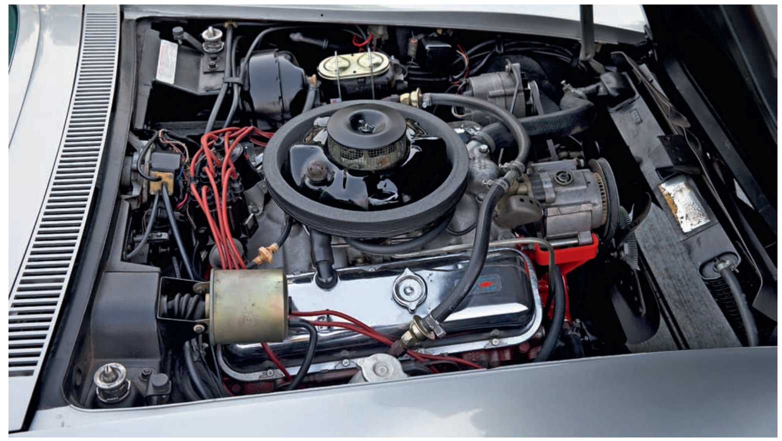
◀ This Silverstone Silver convertible, one of only eighty Corvettes built with the L88 option in 1968, is an extraordinary survivor after traveling only 3,998 miles (6,434.16 kilometers) from new.

▲ All 1968 and 1969 Corvettes equipped with the L88 option left the St. Louis assembly plant with the high-rise hood shown here.

▶ Features unique to the L88 option visible in this unrestored 1968 engine compartment include the open-element air cleaner, large Harrison aluminum radiator, reddish-brown spark plug wires, and the absence of a fan shroud.

▼ Because Chevrolet wouldn't allow L88 Corvettes to be built with a radio, all were fitted with block-off plates where the radio was otherwise installed, and all were delivered new with the gasoline octane warning sticker shown here on the console.

Corvette was not spared the negative impact of expanding government intrusion, but before the effects really took hold in the mid-1970s, Chevrolet's sports car reached new performance milestones that would not be surpassed until more than a decade later, with the introduction of C4. This was accomplished with ultrapowerful engine options, as well as heavy-duty brake-and-suspension packages, that turned otherwise ordinary Corvettes into savage performance machines on the street and the track.



L88

Option L88, first offered by Chevrolet in model year 1967, was also available in 1968 and 1969. As before, the heart of the package was a 427-cubic-inch (6,997.28cc) engine that featured 12.5:1 compression, forged internals, and four-bolt main bearing caps. Large-valve, rectangular-port, aluminum cylinders, and a high-lift, long-duration, solid-lifter camshaft enabled the engine to freely rev to its 6,500-rpm redline. A special hood brought fresh air from the base of the windshield to a large Holley four-barrel carburetor, perched atop an open-plenum aluminum intake manifold.

As in 1967, all 1968 and 1969 L88 Corvettes also came equipped with transistor ignition, Positraction, heavy-duty brakes, and heavy-duty suspension. In 1968 the L88 engine could be coupled only to an M22 heavy-duty manual four-speed, but in 1969 buyers could choose an automatic.

Despite the availability of an automatic, L88-powered Corvettes were, overall, unsuitable for normal street use. Their 12.5:1 compression ratio necessitated the use of high-octane racing gas, they could be difficult to start, and they tended to overheat unless driven at very high speed. Cost was another factor discouraging buyers, with the L88 engine adding $947.90 in 1968, and $1,032.15 in 1969. All the other required heavy-duty options needed when L88 was ordered added about $900 more, meaning the total cost for an L88 was almost 50 percent more than the car's base price.

According to published production figures, Chevrolet's St. Louis assembly plant produced eighty L88 Corvettes in 1968, and another 116 in 1969. Combined with the twenty cars built in 1967, this brings total L88 Corvette production to 216.

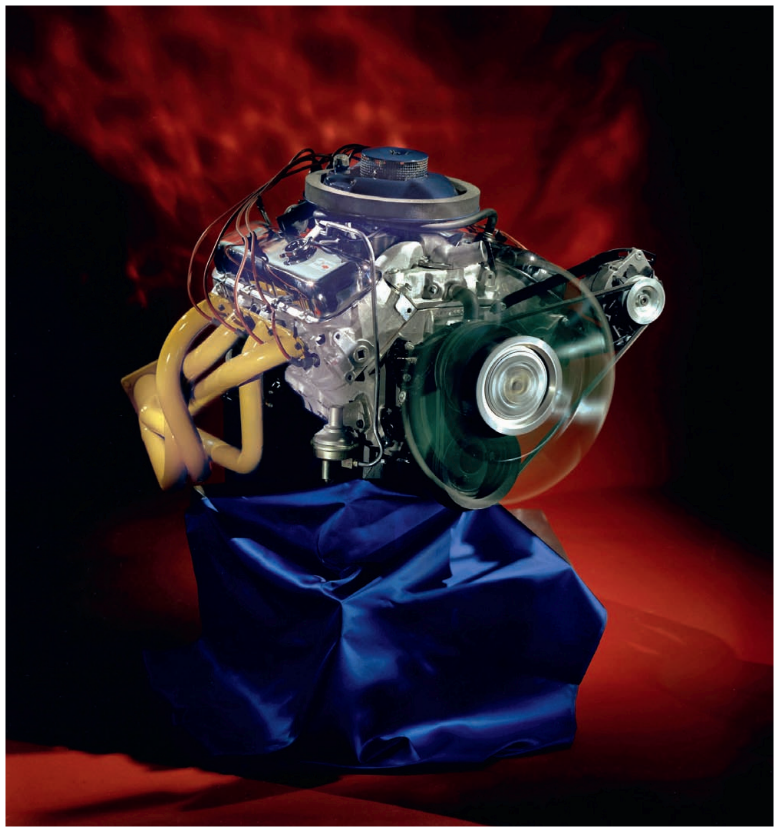
ZL1

For 1969 only, buyers who wanted the ultimate performer—and who had deep enough pockets—could order a Corvette with option ZL1. This came out of Chevrolet's Can-Am racing program and was a derivative of the massively powerful engines propelling McLarens to utter dominance in the Can-Am series. The ZL1 was essentially an L88 built up with a heat-treated 356-T6 aluminum block. Chevrolet engineer Fred Frincke led the design team that created the aluminum block, which used a thicker deck, bulkheads, and cylinder walls, as well as additional internal webbing for added strength. The ZL1 got second-design, open-chamber aluminum heads, which flowed about 30 percent more air than earlier heads. To take full advantage of this added airflow, the all-aluminum big-block received a more aggressive camshaft.

Improved airflow characteristics and superior thermal control in the combustion chamber enabled ZL1 engines to produce about 525 horsepower as delivered in a completely stock Corvette. Opening up the exhaust increased output to 600 horsepower, and further modifications with parts available through the Chevy Power parts catalog enabled these engines to make well over 700 horsepower.

When asked about the kind of person he expected would buy a ZL1 Corvette, Zora Duntov reportedly said, "First, he will have a lot of money." Hand-assembled and precisely balanced in a special clean room at Chevrolet's Tonawanda engine plant in Buffalo, New York, the ZL1 cost an astounding $4,718.35, effectively doubling the base price of a Corvette. As with the L88, buyers also had to pay another $960.35 for the otherwise optional heavy-duty parts that were required, bringing the total for a 1969 ZL1 coupe to $10,459.70. Add delivery charge, sales tax, and a few more options, and the total cost for a 1969 ZL1 Corvette would exceed $11,000, making it the most expensive car produced by any division of GM, including Cadillac, manufactured to that point.

ZL1 Corvettes offered an unforgettable experience for those lucky enough to drive one at racing speed. At the 1969 long-lead press preview, select journalists were given seat time in a ZL1 that had been prepared for drag racing by Chevrolet



◀ With a block cast from 356 T6 heat-treated aluminum, the 1969 ZL1 engine weighed almost 100 pounds (45.36 kilograms) less than a Mark IV iron-block 427.

engineers Gib Hufstader and Tom Langdon. Equipped with a heavy-duty Turbo Hydra-Matic 400 and 4.88:1 gearing, it assaulted the quarter mile in an astounding 10.89 seconds at 130 miles per hour (209.21 kilometers per hour).

Writing for *Motor Trend*, author Eric Dahlquist didn't mince words when it came to describing his impression of the aluminum big-block Corvette: "The ZL1 doesn't just accelerate, because the word 'accelerate' is inadequate for this car. It tears its way through the air and across the black pavement like all the modern big-inch racing machines you have ever seen, the engine climbing the rev band in that leaping gait as the tires hunt for traction, find it, lose it again for a millisecond, then find it until they are locked in."

According to published production figures, two 1969 ZL1 Corvettes were built at the St. Louis Corvette assembly plant, though George Heberling, resident engineer at the St. Louis factory, insisted that only one ZL1 was built at the plant. He said, "I was in that plant every day, and it was my responsibility to know what was happening there. If a second ZL1 was built in the plant, I would have known about it."

Heberling had more than just a passing interest in the ZL1 option. His position with Chevrolet entitled him to a company car, and he could have any vehicle that GM produced. He ordered a fully optioned 1969 Corvette with ZL1, which had a retail price of $10,773.65. After several months of use by Heberling, the car went back to GM and was sold to Hechler Chevrolet in Richmond, Virginia. Hechler had difficulty selling the Corvette, undoubtedly because of its incredibly high price. After three months, John Zagos bought it, then promptly blew up the engine street racing. Both the original engine and a replacement ZL1, which Chevrolet graciously provided under warranty, reportedly ended up in drag racing boats, and the Corvette was eventually sold to Wayne Walker, founder of Zip Corvette, a leading supplier of Corvette restoration parts and services in Mechanicsville, Virginia. Walker restored the car and today it resides in a private collection.

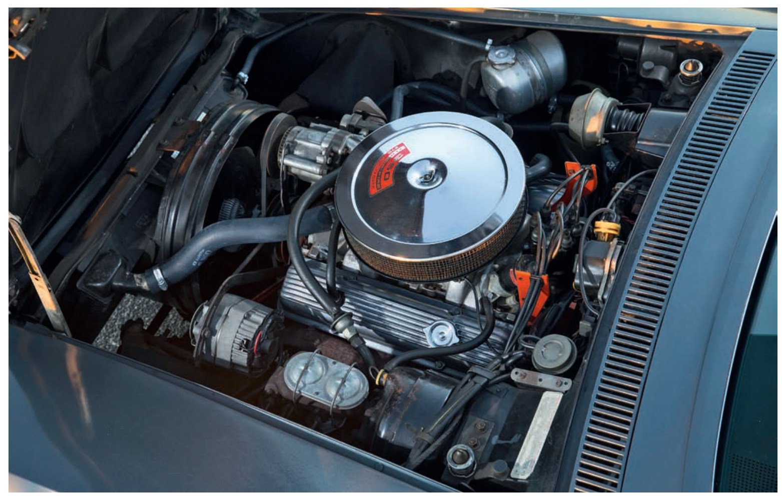
ZR1

Most Corvette enthusiasts believe the first ZR1 Corvette appeared in 1990, but they are mistaken. While 1990 to 1995 C4s powered by the exotic DOHC LT5 engine jointly developed by Chevrolet and Lotus are justifiably famous, the original ZR1, available from 1970 to 1972, was a well-kept secret even back then.

In the tradition of 1957 RPO 579E, 1963 Z06, and 1967–1969 L88 Corvettes, Chevrolet offered ZR1 as a complete road race option package from 1970 to 1972. The heart of the package was the venerable LT1 engine, a powerful 350-cubic-inch (5,735.47cc) V-8 with forged internals, solid-lifter cam,

▶ Buyers of Corvettes with the ZR1 option offered in 1970–1972 could not get a radio, so all came with the block-off plate shown in this 1970.

▶▶ This unrestored 1970 ZR1 has the aluminum radiator, overflow tank, and metal fan shroud unique to the high-performance option package.



and a large Holley four-barrel on a high-rise aluminum intake manifold. From there it strongly resembled the L88s, with a special high-capacity aluminum radiator, M22 heavy-duty four-speed, heavy-duty power brakes, heavy-duty suspension, and transistor ignition.

To discourage its use on the street, Chevrolet would not build a ZR1 with power steering, power windows, a rear window defroster, air conditioning, deluxe wheel covers, factory alarm, or a radio. The option package's price of $968.95 in 1970, $1,010.00 in 1971, and $1,010.05 in 1972, further discouraged buyers, helping to explain why ZR1 production saw only twenty-five in 1970, eight in 1971, and twenty in 1972.

LS6

In 1970 Corvette's optional big-block engines were enlarged to 454 cubic inches (7,439.73cc) courtesy of a longer stroke crankshaft. While the 454 big-block remained available through model year 1974, government-mandated use of unleaded fuel in order to reduce pollution necessitated considerably lower compression. Emissions requirements, as well as noise regulations, also resulted in less aggressive camshafts, milder carburetors, and more restrictive exhausts. Taken together, these changes took the teeth out of the big-blocks. Chevrolet did however make one last stand for Corvette in 1971: the LS6.

Though built with relatively mild 9.0:1 compression, LS6 used a healthy solid-lifter camshaft grind, open-chamber aluminum heads, and forged internal parts in the tradition of its ultra-high-performance forebears. It was rated at 425 horsepower, which was 60 horsepower more than the LS5 454, and 95 horsepower more than LT1, the hot small-block option. But all that power came at a price, a jaw-dropping $1,221.00. It's not surprising that in 1971 only 188 LS6 Corvettes were produced.

ZR2

Only in 1971, Chevrolet sold twelve Corvettes with an option called ZR2. Priced at $1,747.00, the "Special Purpose LS6 Engine Package" included all of the race-oriented special equipment found in the ZR1 package, except ZR2 Corvettes were powered by an LS6 rather than an LT1.

ZR2 Corvettes also were subject to the same restrictions as ZR1s, which meant buyers could not have power steering or windows, air conditioning, a radio, rear window defroster, deluxe wheel covers, or a factory alarm. Unlike the high-performance LT1, LS6 was available with an automatic transmission, unless it was part of the ZR2 package, in which case it had to be coupled to an M22 heavy-duty four-speed gearbox.

▲ This unrestored, exceptionally original Laguna Gray 1970 coupe is one of only twenty-five Corvettes fitted with the $968.95 ZR1 "Special Purpose Engine Package" option that year.


OFFICIAL PACE CAR
62nd ANNUAL INDIANAPOLIS 500 MILE RACE
MAY 28, 1978
1978
Indianapolis
pace car
GOODYEAR
GT RADIAL

12

CHALLENGING TIMES

1973–1982

The period between 1968 and 1982 was a fascinating, tumultuous time in the automotive industry. The beginning of this stretch marked the end of the first golden era of muscle cars. Appropriately equipped Corvettes, such as those sporting the potent L88 or exotic ZL1 option packages, were the undisputed kings of the muscle car epoch. As the 1960s turned into the 1970s, unrestrained power and speed fell victim to increasingly stringent insurance industry demands, government regulations, and market considerations. Research and development dollars that had previously been directed toward enhancing performance were now focused on meeting fuel economy, exhaust emissions, safety, noise, and other requirements. As a result, all cars, including Corvettes, got heavier, clumsier looking, more expensive, and slower. But Corvette, unlike many other cars, weathered the storm with dignity and managed to emerge from this rather gloomy era with its character and place in history intact.

◀ To commemorate the first time Corvette paced the Indy 500 race, Chevrolet built 6,502 Limited Edition Corvette pace car replicas in 1978 and priced them at $13,653.21, which was $4,301.32 more than a base coupe.

Leading Corvette into these challenging times was David R. McLellan, who took the helm as Corvette's chief engineer following Zora Duntov's retirement on January 1, 1975. After earning a BS in mechanical engineering from Wayne State University, McLellan joined GM in 1959 as a senior project engineer in the Noise and Vibration Laboratory at the Milford Proving Ground. He subsequently managed the Vehicle Dynamics Test Area at the proving ground and went on to lead the team of chassis design engineers responsible for the Camaro and Nova chassis.

In July 1973 Chevrolet sent McLellan to a one-year study program in the Sloan School of Management at the Massachusetts Institute of Technology. A year later, upon completion of his MS in management as a Sloan Fellow, he returned to Michigan and was immediately attached to Duntov's group, with a special assignment to work directly with Chevrolet Vice President and General Manager Bob Stempel to manage the introduction of catalytic converters into all of GM's passenger cars, including Corvette. Not a glamorous undertaking, especially for someone who had been part of the dramatic performance advances seen throughout the 1960s, but it was necessary. Amendments to the Clean Air Act of 1963 that were passed in 1970 and regulations originating from the U.S. Environmental Protection Agency (EPA) could not be ignored.

Designed to reduced pollutants, the two-way catalytic converter neutralized the chemicals produced by redox reactions in an internal combustion engine, combining oxygen with carbon monoxide and unburned hydrocarbons to yield less-toxic carbon dioxide, with nitrogen and water as byproducts. The catalytic converter was incompatible with lead, so oil companies began phasing out that substance from their gasoline blends in 1971. Adding lead to gas offered a low-cost way to improve an engine's detonation resistance: the higher an engine's compression, the more likely it was to detonate. To cope with the elimination of lead, Chevrolet and other auto manufacturers reduced their engines' compression ratios, and reduced compression resulted in a concurrent reduction in power.

At the same time cars' actual power was going down, automakers changed the way they quoted engine output, moving from gross horsepower to net horsepower. In simple terms, gross horsepower is a measurement of the engine's horsepower at the crankshaft, running on a dynamometer with no accessories installed. Net horsepower is measured with the engine as installed in the vehicle, along with power-consuming accessories such as the alternator, air injection reactor pump, and cooling fan. Naturally, the net horsepower rating will be lower than the gross horsepower. The real reduction in horsepower, combined with the change in the way power was measured, resulted in dramatically lower power ratings for Corvette engines. For example, the LS5 454 was rated at 390 horsepower in 1970, 365 horsepower in 1971, and only 270 horsepower in 1972.

Changes under the hood weren't the only things impacting Corvette performance in the 1970s. Starting in 1973, the cars got increasingly heavier, which adversely affected every aspect of their operation. Much of this was due to the addition of more emissions-reducing equipment and new safety standards, such as the front impact-absorbing bumper assembly introduced in 1973.

Changing customer expectations in the 1970s was another factor that made Corvettes heavier during this era. Luxury features that added considerable mass, such as power steering, power brakes, power windows, telescopic steering column, and air conditioning, were available in the 1960s, but did not become commonplace until a decade or so later. For example, in 1964 only 8.9 percent of Corvettes built had air conditioning, but in 1974 78.3 percent of the cars made had it.

While acceleration and speed suffered from reduced power and more mass, Corvette's handling actually improved during the 1970s primarily as a result of advances in tire technology. Beginning in 1973, Corvettes left the St. Louis factory with steel-belted radials. Besides the change in construction, these GR70x15 tires were wider than the F70x15 tires that had been in use since 1968. Even wider P255/60Rx15 tires were optional for C3s from 1978 to 1982.

Buyers interested in maximizing handling, as well as braking, could still get an optional race-oriented chassis package through 1975. The Z07 Off Road Suspension and Brake Package included higher-rate front and rear springs, larger-diameter front stabilizer bar, stiffer shocks, dual-pin front calipers supported by an extra brace, heat insulators for the caliper pistons, metallic brake pads, and power assist for the brakes. Z07 was available only with an optional LS4 or L82 engine and four-speed manual transmission and could not be combined with air conditioning. Z07 cost $369.00 in 1973, and only forty-five of the 30,464 Corvettes produced that year got it. The price rose to an even $400.00 for 1974 and 1975, and production increased to forty-seven cars in 1974, and 144 cars in 1975.

From 1974 to 1982, option FE7, called Gymkhana Suspension, provided the higher-rate springs and larger anti-roll bar that were part of the Z07 package. FE7 cost only $7.00 in 1974 and 1975, but the price had risen to $61.00 by 1982. Buyers found the lower cost far more attractive, not to mention the ability to order it with any engine and transmission combination and air conditioning.

With engineering resources devoted almost exclusively to coping with government regulations, Chevrolet Design was tasked with finding other ways to keep customers interested in buying new Corvettes. The C3's appearance changed markedly in 1973, with the elimination of the vacuum-actuated windshield wiper door and installation of

◀◀ In 1973 4,412 Corvettes were built with the $250.00 LS4 454-cubic-inch (7,439.73cc) engine option, which produced 275 horsepower.

◀ Corvette's standard 350-cubic-inch (5,735.47cc) engine was rated at only 195 horsepower in 1975, which ironically was equal to the rating of the 1955 265-cubic-inch (4,342.6cc) V-8.

▼ Because of diminishing demand, convertible production came to an end in late July 1975 and didn't resume until 1986.

▶ Chevrolet has never made a determined effort to sell Corvettes outside of the United States and Canada, but examples from every year can be found around the world, including this 1978, which was imported into England and then brought to France.

body-colored, urethane-covered impact absorbing bumpers in the front. In 1974 the rear got a urethane bumper as well, leaving the driver's door mirror and standard wheel center caps as the only remaining exterior chrome pieces.

Rally wheels with center caps and stainless trim rings remained standard for all C3s, but a full wheel cover introduced in 1968 was optional through 1973. Handsome cast-aluminum wheels became optional in 1973, but because of air leaks caused by porosity problems, only four cars left the St. Louis plant with these wheels, and all were reportedly recalled. The wheels were listed on the order form in 1974, but ongoing manufacturing difficulties prevented Chevrolet from installing them on Corvettes until 1975.

Because it did not comply with stricter emissions and fuel consumption mandates from the federal government, the 454 engine made its final appearance in 1974. In the next year, buyers could have the standard 350-cubic-inch (5,735.47cc), 165-horsepower engine, or the optional L82 350 that delivered 205 horsepower for $336.00 extra. Both available engines used GM's high energy ignition (HEI) and could be coupled to either a three-speed automatic or a four-speed manual transmission.

In a stark break with Corvette heritage, convertibles were no longer available after 1975. More than anything else, this was a reaction to the marketplace. Convertibles outsold coupes every year from the coupe's introduction in 1963 through C3's first year in 1968, but in 1969 the balance flipped, with Chevrolet building 22,129 coupes and 16,633 convertibles. In 1975, only 4,629 of the 38,465 Corvettes manufactured were convertibles.

Corvette got a significant facelift in 1978. The vertical rear window and flat rear deck introduced in 1968 were replaced with a large, curved window that gave Corvette a completely new, fastback look and much-needed additional interior room. The fixed rear glass was a low-cost alternative to a functional glass hatch, first explored in 1973 but deemed too expensive to produce at the time. Corvette's interior was also extensively updated for 1978, with redesigned door panels and instrumentation, plus the inclusion of a glove box in the passenger side dash, something not seen since 1967.

On the marketing front, all 1978 Corvettes were "Silver Anniversary" cars, receiving special nose and horn button badges designating them as such. In addition, for $399.00 buyers could have B2Z Silver Anniversary Paint. This option's attractive two-tone light silver upper/dark silver lower body paint scheme came from the Chevrolet III Studio, under the leadership of the studio's chief designer, Jerry Palmer, and 15,283 Corvettes rolled off the line with it.

◀ All 1978 Indy 500 pace car replicas came with a bespoke silver interior and redesigned seats that were each about 12 pounds (5.44 kilograms) lighter than the standard 1978 seat.

▲ In 1980, when new fender vents and front and rear fascias with integral spoilers were introduced but little else changed, the base price for Corvette rose $2,920.01 to $13,140.24, an increase of 28.57 percent, which helps explain why production fell 13,193 units to 40,614.

In addition to the Silver Anniversary Paint option, Palmer was responsible for designing another special offering in 1978, the Limited Edition Corvette Indy 500 pace car. Chevrolet first supplied a pace car for this iconic race in 1948, when a Stylemaster convertible enjoyed the honor. In 1955 the all-new Bel Air got the call, and Camaros paced the race in 1967 and 1969.

The 1978 Corvettes that paced the Indy 500 were distinguished by their unique two-tone paint, featuring black over silver with a red accent stripe at the mating line. Chevrolet produced 6,502 Limited Edition Corvette pace car replicas, reportedly one for every Chevy dealer. All were equipped with glass T-tops, polished aluminum wheels, air conditioning, power door locks, rear window defogger, sport mirrors, tilt/telescopic steering column, heavy-duty battery, and an AM/FM stereo. Pace car interiors were silver and featured special badging and new seats with greater lumbar support.

Every 1978 pace car came with a special set of body stickers, but it was up to the dealer to install them if the buyer wished. Two more features unique to pace cars were front chin and rear deck spoilers grafted onto the otherwise stock body. These spoilers were functional, together reducing drag coefficient from about 0.503 to 0.420 and simultaneously decreasing high-speed lift.

In 1979 the lighter and more supportive seats included with 1978 pace cars were standard, and the mirrored-glass T-tops and body spoilers first seen in the pace cars became optional. Building on the success of these spoilers, Corvettes appearing from 1980 to 1982 came with redesigned fascias that integrated them, further reducing drag and lift while simultaneously increasing airflow to the radiator by almost 50 percent.

In the never-ending quest to improve fuel economy, the engineering team led by Dave McLellan found significant weight savings as the C3 era wound down. The use of lower density T-tops, thinner hood and door skins, and aluminum for the differential housing and crossmember saved more than 60 pounds (27.21 kilograms); new impact-absorbing bumper substructures that used fiberglass in place of steel trimmed 84 pounds (38.10 kilograms); and an aluminum intake manifold netted another 24 pounds (10.89 kilograms). Considering the addition of items that added weight—such as making air conditioning, power windows, and tilt/telescopic steering column standard—it's impressive that the engineers were able to bring a base 1980's curb weight down by 169 pounds (76.66 kilograms), to 3,334 pounds (1,512.28 kilograms) total.

Further weight savings were achieved in 1981, in Corvettes equipped with an automatic transmission and standard suspension, with a fiberglass-reinforced plastic rear transverse

▲ C3 styling exercise with several features that didn't go into production, including exposed headlights and B-pillar vents.

▶ One of numerous C3 interior design studies from the 1970s that didn't make it to production.

monoleaf spring in place of the multi-leaf steel spring used since 1963. Developed by the Polymer Material Processing Lab at GM's Inland Division, the new spring weighed only 8 pounds (3.63 kilograms). Compared with the 48-pound (21.77-kilogram) steel spring it replaced, this represented an 83 percent weight savings. McLellan called this "the largest, single weight savings I have ever witnessed."

Tubular stainless-steel exhaust headers, first used on 1980 Corvettes fitted with the California-only 305-cubic-inch (4,998.05cc) V-8, became standard in every 1981 and saved 14 pounds (6.35 kilograms). Weight-saving magnesium valve covers were also standard starting in 1981.

Though increasing fuel economy was the primary motivation for these changes, reducing weight also had the added benefit of improving performance. As the C3 era closed, something else emerged that would ultimately enable Chevrolet's engineers to recover all the performance that had been lost while also bringing Corvette to new levels of performance undreamed of in the 1960s.

Starting in 1980, Corvettes sold new in California were equipped with rudimentary computer controls for the engine and drivetrain. The Computer Command Control (CCC) system was installed in all Corvettes in 1981. The primary mission of CCC was to integrate the emissions and fuel systems in order to improve gas mileage and reduce exhaust emissions by automatically adjusting ignition timing and air/fuel mixture. The latter was accomplished via a hybrid Rochester Products carburetor incorporating a single pulsed electronic fuel injector. Input from an oxygen sensor in the exhaust stream enabled the computer to control the fuel injector and meter gas, which achieved the desired stoichiometric air/fuel ratio for minimum emissions. To further improve fuel economy and reduce emissions, CCC also locked up the automatic transmission's torque converter in second and third gears when certain parameters were met, thus eliminating frictional loss.

Manual transmissions were not available in 1982, and all cars were equipped with Chevrolet's new 700 R4 four-speed automatic. At the same time, the crudely digitized analog carburetor used in 1981 was replaced with a throttle body fuel-injection system called Cross-Fire Injection. It used two throttle body injectors on a single-plane open manifold that was reminiscent of the cross-ram induction system used in 1969 Z28 Camaros racing in the Trans-Am Series. This system was somewhat prone to failure and inherently inefficient because the single-plane manifold could not evenly distribute air and fuel to all eight cylinders, helping explain why it was used for only two years.

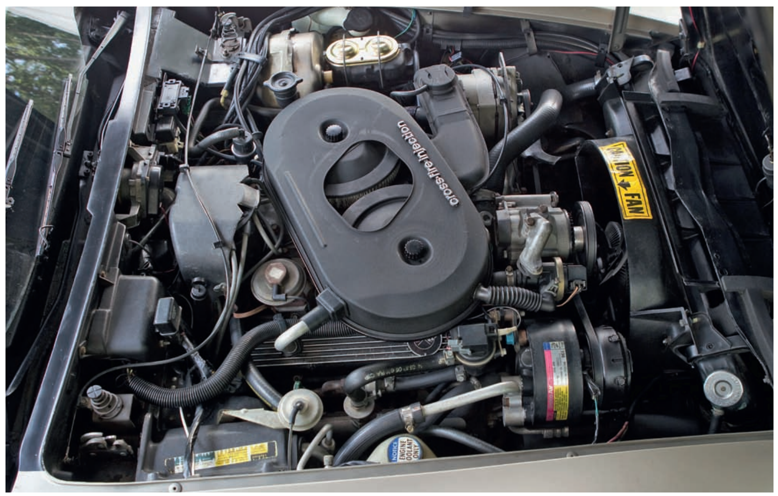
At the same time the engineers were doing what they could to improve performance while simultaneously meeting progressively stricter fuel economy, emissions, safety, and noise mandates, Corvette's stylists were busy designing something special to close out the C3 era. Encouraged by the sales success of the 1978 Indy pace car program, they created the 1982 Corvette Collector Edition Hatchback. It was distinguished by bespoke silver-beige paint, fading shadow treatment on the hood, fenders and doors, bronze-tint glass T-tops, cloisonné emblems, turbine-style wheels, an opening glass hatch, and a silver-beige leather interior. Chevrolet sold 6,759 of the $22,537.59 Collector Editions, ending the fifteen-model-year C3 run in high style.

CORVETTE GETS A NEW HOME

Corvette assembly began in St. Louis in December 1953 and continued there for almost twenty-eight years. By August 1, 1981, when production in St. Louis concluded, almost 700,000 Corvettes had been built in the Gateway City. Sadly, however, the plant had simply outlived its practical usefulness. Corvette's portion of the facility began in the 266,025-square-foot Fisher Mill Building and over time had expanded to encompass almost 500,000 square feet. It was designed for assembling up to 10,000 cars per year, but production passed that figure in 1960 and never looked back. In 1980, 40,614 Corvettes were assembled in the St. Louis plant, more than four times its intended capacity.

While the St. Louis plant found innovative ways to cope with building so many Corvettes, it could not overcome a problem presented by new EPA rules regulating emissions coming from its painting operations. General Motors Assembly Division (GMAD), the group solely responsible for operating the St. Louis plant since 1971, concluded that a total overhaul of the facility's paint shop was needed to meet the impending emissions regulations. But a total rebuild of the existing paint lines required shutting down the entire plant for a year, which was not acceptable. The only feasible alternative was to build a new paint shop while the old one continued operating. This was further complicated by the location of the St. Louis plant, surrounded as it was by developed properties with no room to expand. That left only one solution, which was to move Corvette production elsewhere and use the space it consumed to build a new paint shop for the other vehicles assembled in St. Louis.

In 1981, Chevrolet transitioned Corvette assembly to a one-million-square-foot facility some 300 miles southeast, in Bowling Green, Kentucky. The Bowling Green assembly plant was not a new structure, having served previously as a Chrysler Corporation air conditioning plant, but it was gutted and completely rebuilt for Corvette production. The first Corvette rolled off the line in Bowling Green on June 1, 1981, marking the beginning of a beautiful relationship that endures to this day.



◀◀ The 1982 Corvette Collector Edition Hatchback model included several items that were optional on base cars, including glass T-tops, rear window defogger, and P255/60R15 white-letter tires, along with unique features such as Silver Beige paint, graduated body accent decals, and aluminum wheels.

◀ Cross-Fire Injection, found in 1982 and 1984 Corvettes, used two throttle body injectors on a single-plane open manifold controlled by a computer that adjusted it eighty times per second to minimize emissions.

13

STYLING AND ENGINEERING

SPECIALS OF THE 1970s

◀ The *Corvette 4-Rotor*, later renamed *Aerovette*, was as radical as it was beautiful, with a 72-degree sloped windshield, bi-hinged gullwing doors, and elegantly aggressive shape.

Corvette's third generation lasted an unprecedented fifteen years, the longest in the marque's history. While cutting-edge styling and superlative performance delineate C3's early years, its final decade was defined by aging design and increasingly outdated technology. If sales suffered as a result, it wasn't readily apparent, with Corvette production rising steadily and ultimately peaking at 53,807 in 1979. While good for Chevrolet's bottom line, strong demand despite diminishing performance and increasingly dated styling actually hurt Corvette's long-term viability because it discouraged investment by GM's upper management. Those directly responsible for Corvette—including chief engineers Zora Duntov and Dave McLellan and the stylists working under Jerry Palmer in Chevrolet III Studio—devoted most of their limited resources to meeting ever more stringent fuel economy, emissions, safety, and noise regulations. To their credit, however, these keepers of the flame still managed to create several noteworthy Corvette styling and engineering vehicles in the 1970s.

XP-882

Though Zora Duntov's efforts to put a mid-engine C2 or C3 Corvette into production had failed, he was not one to give up easily. In 1968 he got approval to build another experimental mid-engine car, *XP-882*. To overcome the primary obstacle to bringing such a car to market, he had to use existing GM drivetrain components whenever possible. The only transaxle then in production was the one used in Oldsmobile's front-wheel-drive Toronado since 1966 and Cadillac's El Dorado beginning in 1967. It was far from ideal for a high-performance sports car, because it was made only for an automatic transmission and its configuration resulted in the engine being too high.

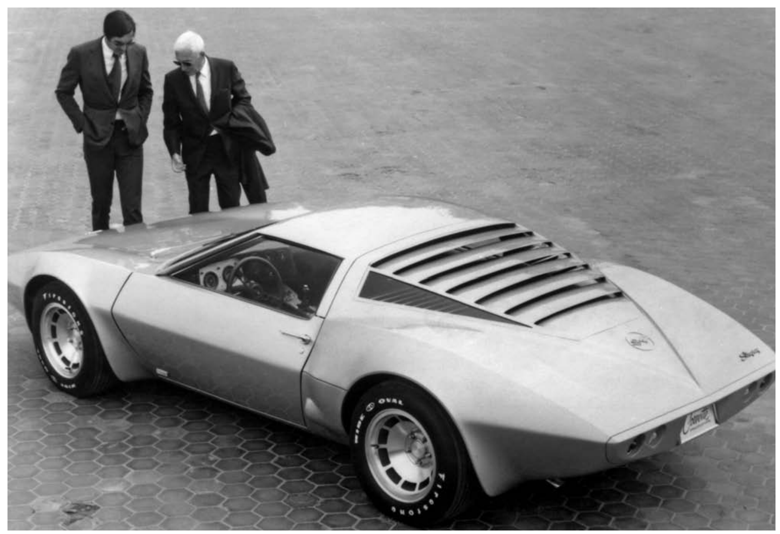
Working with Walt Zetye and others, Duntov conceived of an innovative solution to the engine placement dilemma. He located *XP-882*'s V-8 transversely, mounted the transmission between the engine and passenger compartment, put the differential on the other side of the engine, and ran a driveshaft inside a tube that passed through the engine's oil pan. By placing the engine transversely and then making efficient use of the space on both sides of it, this unconventional layout, which earned Duntov a patent in May 1971, allowed for a relatively small, low-slung car with sufficient passenger compartment room and a useable trunk.

Though not incorporated into the build of *XP-882*, Duntov's patent included numerous additional features, among them provisions for four-wheel drive with fluid coupling differentials front and rear, and the substitution of a manual gearbox in place of the automatic while still retaining a torque converter mounted to the engine's crankshaft.

The clever packaging of its engine and drivetrain gave *XP-882* a low and wide stance. It was about 6 inches (15.25 centimeters) lower than a C3 coupe and, at 75 inches (190.5 centimeters) from side to side, its smooth, chiseled body was a full 6 inches (15.25 centimeters) wider than a production Corvette's body. The finished car weighed 3,000 pounds (1,360.78 kilograms), distributed 44/56 front-to-rear. While not exceptional, the weight was reasonably low given that its 400-cubic-inch (6,554.83cc) engine and unconventional drivetrain together weighed almost 830 pounds (376.48 kilograms). To compensate for the extra shafts, gears, and other heavy steel parts used for the innovative drivetrain, the engineering team working on *XP-882* selectively used lightweight materials elsewhere, including magnesium for the wheels and aluminum for the brake calipers.

Performance was enhanced by a very capable welded-steel platform and boxed space-frame chassis using four-wheel

▶ *XP-882* was built as an engineering study in 1968, retired in 1969, and then, at the urging of Zora Duntov, refinished to show standards and displayed at the New York Auto Show in April 1970 with the unimaginative name *Corvette Prototype*.



▶▶ In 1969 Chevrolet general manager John DeLorean, shown here with Zora Duntov, thought the next-generation Corvette should be built using GM's F-Body platform, the semi-unibody structure underpinning Camaro and Firebird. With that decision, mid-engine engineering studies halted, including for *XP-882*, but DeLorean reversed course after seeing the reaction *Corvette Prototype* got at the 1970 New York Auto Show.

◀ After returning from the 1970 New York Auto Show, *XP-882* got this new body, designed primarily by Chuck Jordan and Henry Haga, and underwent testing at the Milford Proving Ground with a 454 engine, manual gearbox, and a new name, *XP-895*.

independent suspension, coil-over shocks, rack-and-pinion steering, and disc brakes. The fuel tank, radiator, and a space-saving spare tire were placed up front.

XP-882 was initially built as an internal engineering study, then reportedly shelved in 1969 by Chevrolet's new general manager, John DeLorean, who was pressing his engineers to explore the feasibility of building the next-generation Corvette on a shortened version of the Camaro platform. It got a new lease on life the following year when, at the urging of Duntov, GM design boss Bill Mitchell and Chevrolet Engineering Director Alex Mair decided to finish to show standards one of the two *XP-882* chassis built. They would display it at the 52nd Annual New York Auto Show in April 1970, calling it simply *Corvette Prototype*.

Despite that decisively unimaginative name, the elegant but aggressive wedge-shaped fastback design, penned primarily by Jerry Palmer and Henry Haga, stole the show in New York. The car outshone the other mid-/rear-engine prototypes, including Ford's de Tomaso–built Pantera, American Motor's Bizzarrini-designed *AMX/3*, and the fiberglass-bodied, Bruno Sacco–designed, four-rotor Wankel-engine-powered Mercedes Benz *C 111-II*. Duntov and others hoped that C3's successor would in fact be mid-engined, and the great enthusiasm the public and motoring press alike showed for the gleaming silver *Corvette Prototype* inspired DeLorean to reverse course and authorize further development.

XP-895

After returning from the April 1970 New York Auto Show, *XP-882* got a new manual transmission configuration to work with a 454 engine. In addition, the 15-inch (38.1-centimeter) diameter wheels were widened an inch (2.54 centimeters), bringing the fronts to 9 inches (22.86 centimeters) and the rears to 10 inches (25.4 centimeters). Concurrent with the mechanical changes, Bill Mitchell's styling team, which included Charles "Chuck" Jordan and Henry Haga, designed a new body for the car. The extreme angularity and crisp peaks of *XP-882* were replaced with a more curvaceous body wearing bulging fender flares. The new body bore a strong resemblance to early C3s, with peaked arches over the wheels, a short vertical back window framed by buttresses atop a flat deck surface, and rotating headlight assemblies. To enhance cooling, it incorporated twin NACA ducts on the hood, a rear vented bulge above the engine, and slender, vertical ducts just forward of each rear wheel.

Enough changes were made to *XP-882* that it got a new internal designation, *XP-895*. By the fall of 1971, the completed car, built with steel body panels in place of *XP-882*'s fiberglass outer skin, was running at the Milford Proving Ground. Predictably, it was too heavy, having gained some 500 pounds (226.79 kilograms) due in part to the switch from fiberglass to steel for its body sheathing.

▶ Though styled and finished to the highest standard, *XP-895* was also an engineering vehicle used to test the viability of its powertrain and the use of aluminum to construct its body.

DeLorean, who was by then playing an active role in the experimental car's design and testing, turned to the Reynolds Metals Company. In the 1960s Reynolds was the third-largest producer of aluminum in the world and was actively seeking opportunities to expand into new markets, including the automobile industry. The next decade saw Reynolds in an established relationship with GM as the supplier of various aluminum parts, most notably the ill-fated Chevy Vega engine block. Reynolds agreed to work with Chevrolet to create a new, lightweight body for *XP-895*.

Beginning in March 1972, Reynolds supplied the needed materials to make a completely new body for *XP-895*, including sheets of 2036-T4, an aluminum alloyed primarily with copper and, to a lesser extent, magnesium. This blend, in concert with solution heat treatment and natural aging, gives 2036-T4 sheets formability comparable to mild steel, thus making them well suited to automobile bodies. The aluminum body for *XP-895* was made at Creative Industries of Detroit, a specialty prototype fabricator that had a hand in making many vehicles for GM, ranging from the original Motorama Corvette to the steel-bodied *XP-895*. The process was a learning experience for both Reynolds and Creative Industries, and they determined that a combination of spot welds and epoxy was the best method for joining adjacent panels to each other and to the underlying structure. They also learned a great deal about efficiently forming aluminum body parts for a relatively high-volume vehicle, which would be necessary if *XP-895* formed the basis of the next-generation Corvette.

To the delight of DeLorean, Duntov, the people at Reynolds, and everyone else involved, the finished *XP-895* aluminum body weighed almost 500 pounds (226.79 kilograms) less than the 1,150-pound (521.63-kilogram) steel body it replaced. That motivated Chevrolet to do a detailed cost analysis to put a refined version of the lightweight mid-engine car into production. Unfortunately, the cost to manufacture the aluminum body and substructure would be dramatically higher than similar fabrication with either steel or fiberglass. That, combined with the other incremental costs associated with putting the engine behind the driver, once again brought the idea to an abrupt end.

XP-897GT/CORVETTE 2-ROTOR

Dr. Felix Wankel began developing a thermodynamic rotary engine in 1925. His research and experimentation led him to create, in 1954, the fundamentals of the rotary engine

◀ *XP-895* performance showed promise, but it was too heavy, due in part to a 1,150-pound (521.63-kilogram) steel body, so a new body was fabricated in 1972 using 2036-T4 aluminum, which trimmed almost 500 pounds (226.79 kilograms).

that bears his name. His design incorporated a curvilinear triangle rotating in an appropriately contoured case, forming three chambers that alternately increase and decrease their volume. This action provided for induction, compression, combustion, and exhaust, thus satisfying all the requirements for a conventional reciprocating-piston four-stroke engine, but doing so with far fewer parts in a lighter, more compact package.

Wankel's groundbreaking design was significantly simplified and refined by NSU Motorenwerke AG engineers Hanns Dieter Paschke and Dr. Walter Froede, then put into production in 1964 for the NSU Spider. It was also employed by NSU, with disastrous results, in its Claus Luthe–designed Ro 80. From 1967 to 1977, a total of 37,398 Ro 80 sedans were produced, and design, manufacturing, and materials deficiencies in the twin-rotor Wankel engines necessitated replacing every one of them at least once, sometimes multiple times, under warranty, which ruined NSU financially and led to its acquisition by Volkswagen Group in 1969.

Ed Cole, whose brilliance and passion brought about his meteoric rise at GM, thought the company's unprecedented technical resources could overcome problems in the Wankel/NSU rotary engine and unleash its full potential. In November 1970, three years after his promotion to president of GM, Cole orchestrated an agreement to license the engine's patents, then held by Wankel GmbH, Audi-NSU, and Curtiss-Wright. The total cost for the worldwide licensing agreement was $50 million, payable in six yearly installments starting with $5 million in December 1970 and concluding with the final $5 million in December 1975. GM retained the right to cancel the contract at any time with no further obligation if it desired. The resulting powerplant would be called the General Motors Rotary Combustion Engine (GMRCE).

At the same time Chevrolet Engineering and GM's Hydra-Matic Division were attacking the rotary engine's problems, most notably the difficulty of sealing each rotor to its housing, work got underway on an experimental car that would showcase the new engine's strengths. This prototype foreshadowed the first high-volume cars Cole anticipated powering with it, namely the Vega and its progeny, the Chevy Monza. The new car, which was known internally as *XP-897GT* or the *Chevrolet GT*, was penned primarily by John "Kip" Wasenko in Dick Finegan's Experimental Studio. The absence of "Corvette" in the prototype's name was not an oversight—GM Design, which was responsible for the project, envisioned

▶ Under the leadership of Ed Donaldson, the interior for the *Corvette 2-Rotor* was fabricated and installed by artisans in the Chevrolet Experimental Interiors Studio.

▼ The body for this rotary-engine-powered experimental car, initially called *Chevrolet GT* and later renamed *Corvette 2-Rotor*, was designed primarily by Kip Wasenko in Dick Finegan's Experimental Studio and fabricated for Chevrolet by Pininfarina in Turin, Italy.

it as a halo car that went beyond Corvette's borders. No surprise, then, that *XP-897*'s body looks a lot more like the 1975–1980 Chevrolet Monza 2+2 than any Corvette.

Late in 1971, after the *Chevrolet GT*'s body shape was essentially complete, Clare MacKichan, GM's chief of advanced design, enlisted legendary Turin-based design firm Pininfarina to build it. The Italian firm committed to complete the body in time to return it to Michigan for final assembly in April of 1972 and the planned showing of future products to GM's board of directors the following month. But the craftspeople at Pininfarina, led by Otto Soeding, could meet their deadline only if they received the *Chevrolet GT*'s chassis by mid-January.

At the end of November 1971, the impossible task of designing and fabricating a chassis in a matter of weeks was handed to Duntov's engineering group. Their solution was pragmatic and clever, if not entirely palatable to some. A small team of dedicated men, led by Walt Zetye, began with an existing mid-engine chassis, the then-new Porsche 914, and made all the necessary modifications for it to work with the *Chevrolet GT* body and GMRCE. To complete their task, Zetye and his colleagues worked every day from December 3, 1971, until January 14, 1972, which is the day the finished chassis was loaded on a cargo plane destined for Turin.

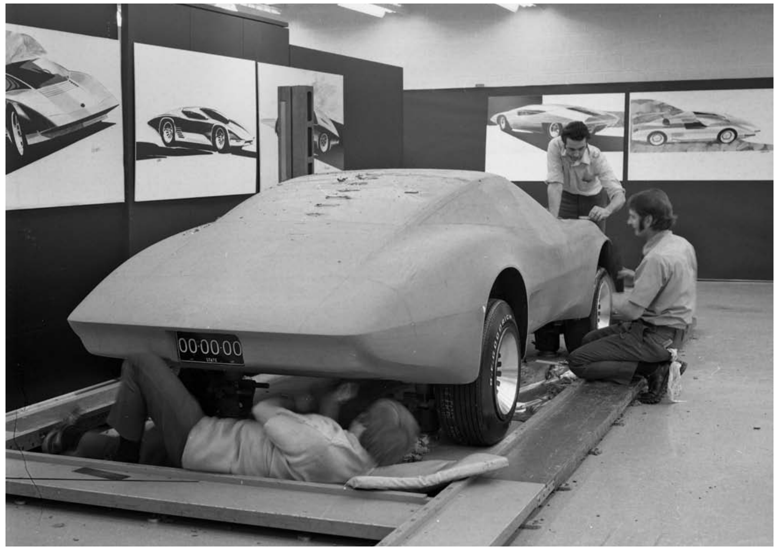
Three months after landing in Italy, the *Chevrolet GT* chassis, now mated to a beautifully crafted body, returned to Michigan for completion. It went to Chevrolet's Experimental Interiors Studio, where a team of skilled artisans and technicians, led by studio chief Ed Donaldson, fabricated and installed a bespoke interior featuring electrically adjustable leather-covered seats, tilt and telescoping steering column, and a full array of gauges.

As planned, a two-rotor GMRCE called RC2-266 was mounted at the rear, offset approximately 7 inches (17.78 centimeters) to the right. A three-speed aluminum automatic transmission was positioned to the left of the engine. With a single Rochester four-barrel carburetor feeding both rotors through side inlet ports, the engine peaked at about 180 horsepower at 6,100 rpm, which was enough to give the 2,600-pound (1,179.34-kilogram) car reasonable performance.

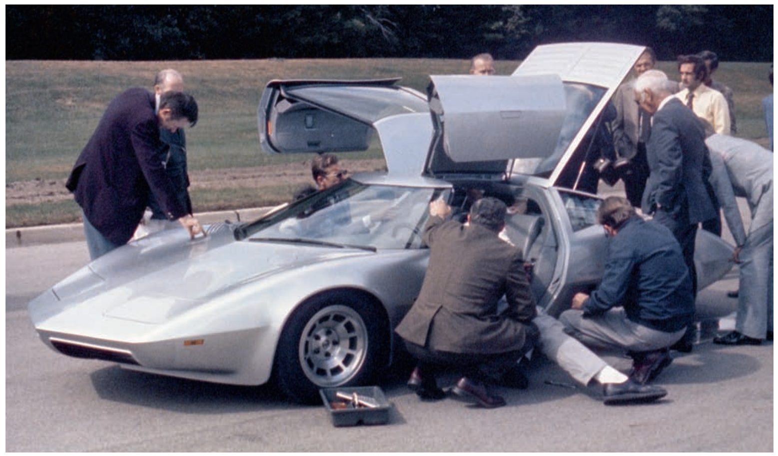
In September 1973, more than a year after the car was built, Chevrolet changed its name to *Corvette 2-Rotor* and displayed it at the Frankfurt Auto Show. After appearing in several more shows, it was put into storage at a Vauxhall facility in Great Britain, where it remained until it was purchased by Corvette collector Tom Falconer in 1983. The GMRCE RC2-266 engine and transmission were gone, so Falconer fitted a Mazda 13B rotary engine and front-wheel-drive Cadillac transmission and got the car operational once more.

CORVETTE 4-ROTOR/AEROVETTE

Both *XP-882* and *XP-895* were rejected for production. Undaunted, Duntov saw, in Ed Cole's passion for the rotary engine, an opportunity to revive the notion of a mid-engine Corvette. In March 1972 he asked brilliant engineer Gib Hufstader to think about how they could get more power out of the GMRCE. One way was to design an engine with more rotors, but Duntov's engineering group lacked the time and money to do that from scratch. Hufstader reasoned, however, that they could create a four-rotor engine by joining two two-rotor engines together. It wouldn't be easy, and it probably wouldn't be pretty, but it was workable and would at least showcase the potential of the innovative technology to deliver Corvette-worthy performance.



◀ Extremely talented technicians carefully sculpt clay, bringing to life the stunning design for the *Corvette 4-Rotor* experimental car.



▼ As both a styling exercise and engineering test vehicle, the *Corvette 4-Rotor* got a lot of attention from the designers and engineers who produced it, including Gib Hufstader, *second from right*, who was responsible for creating its highly unusual four-rotor rotary engine.

Hufstader started with two RC2-195s, which were early-development two-rotor GM engines. He designed and fabricated a steel box that mated the two engines side-by-side, but facing in opposite directions, so the front of one was aligned with the back of the other. The two engines drove a common steel shaft, which in turn drove the ignition distributor, alternator, and oil pump. Twin V-belts on one of the two-rotor engines spun an air conditioning compressor, power steering pump, and water pump. Joining the cooling and oil passages of the two engines allowed for the use of one water pump and one oil pump.

Hufstader took only two months to go from concept to running prototype, and the finished four-rotor produced 370 horsepower during dynamometer testing—more than the 454-cubic-inch (7,439.73cc) V-8 then available in Corvettes. And even though it was the largest automotive rotary engine ever built, at a displacement of some 585 cubic inches (9,586.43cc), it was still lighter than the 454.

Hufstader's four-rotor engine was designed to fit easily in one of the *XP-882* chassis, and, unlike the two-rotor *Chevrolet GT*, this more powerful car would be labeled a Corvette from the outset. In June of 1972, after four weeks of dyno testing, the new engine was installed in *XP-882* for track evaluation. As predicted, it propelled the car from a standing start to 100 miles per hour (160.93 kilometers per hour) quicker than a production 454 Corvette. On the one-mile-long check road at GM's Technical Center in Warren, it hit 148 miles per hour (238.183 kilometers per hour) before running out of tarmac, still accelerating strongly.

Ed Cole was the man behind the wheel for some of the Tech Center testing, and the car's incredible performance only increased his support for it. Cole asked Bill Mitchell to design a new body, directing him to give this highly visible platform—one destined to showcase GM's rotary engine prowess—its own look.

Under Mitchell's watchful eye, Chuck Jordan supervised the design work, which began in January 1973. Jerry Palmer and Henry Haga collaborated in the Chevy III studio to reinterpret *XP-882*'s design. The result, called *Corvette 4-Rotor*, featured a windshield sloped an incredibly steep 72 degrees, bi-hinged gullwing doors, and dramatically tapered and angular nose and tail. Testing in Cal Tech's GALCIT wind tunnel in April 1973 revealed that this dramatic design was as efficient as it was beautiful, with a drag coefficient of only 0.325.

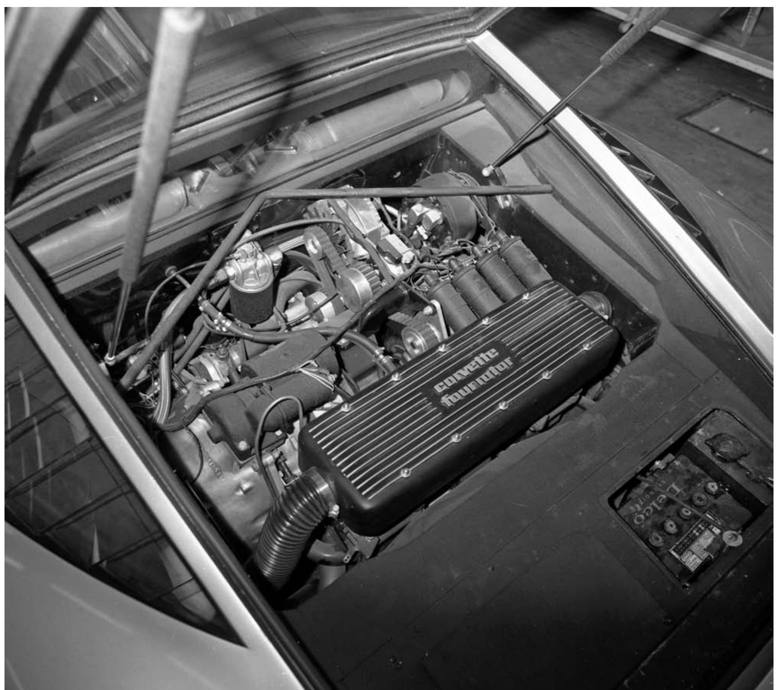
The *Corvette 4-Rotor*'s body was built in GM Design's fabrication shop using fiberglass panels bonded to a substructure of rectangular steel and aluminum tubes. The same technicians who crafted the body built and installed the car's complex interior, which had been created in Design Staff's Interior Studios under the leadership of Don Schwarz, with most of the actual work being done in the Chevrolet studio by a small team headed up by Jim Orr.

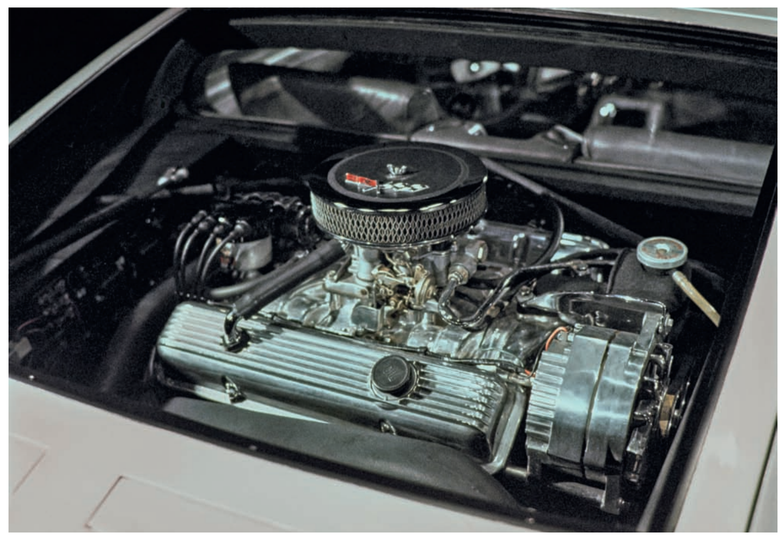
The *Corvette 4-Rotor* made its public debut at the Paris Auto Salon in October 1973. Not surprisingly, it was widely heralded as a design masterpiece. Even Duntov, who always favored function over form and rarely had nice things to say about the work coming out of GM's styling studios during his time with the company, called it "the best body that Bill Mitchell ever designed."

While the *Corvette 4-Rotor* and *Corvette 2-Rotor* garnered tremendous praise for their beautiful designs, all was not well under the skin. Despite GM's vast technical resources and Ed Cole's unqualified commitment to the effort, engineers realized, while these cars were still under construction, that there were no easy solutions to the rotary engine's intrinsic

▶ The engine Gib Hufstader created for the *Corvette 4-Rotor* by combining two RC2-195 two-rotor engines displaced 585 cubic inches (9,586.43cc), produced 370 horsepower, and weighed less than Chevrolet's 454 V-8, but high emissions and poor fuel economy dissuaded GM from continuing to develop rotary engines.

▶▶ In 1974, after GM discontinued its rotary engine development program, the *Corvette 4-Rotor* was brought back to Michigan, reconfigured with a conventional small-block Chevy V-8, and renamed *Aerovette*.





◀ Henry Haga, *left* and Chuck Jordan, along with others in the Chevy III Studio, all working under GM Design leader Bill Mitchell, styled the gorgeous body for the *Corvette 4-Rotor* in 1973.

shortcomings. Poor fuel economy and high emissions were particularly vexing, especially at a time when increasingly stringent regulations made it difficult to certify even GM's inherently more efficient engines.

In late 1974, before the final two rotary engine licensing payments of $10 million and $5 million toward the $50 million total were paid, GM "suspended" its GMRCE program indefinitely. With all rotary engine development shelved for good, there was no need for rotary-powered show cars or test cars. The *Corvette 4-Rotor* was brought back to Michigan, reconfigured with a conventional small-block Chevy V-8, and renamed *Aerovette*. It resides in the permanent collection of the GM Heritage Center.


JOHN GREENWOOD
Racing
DYNACOR
Lifesaver Street Radial
50
CIBIE

14

PRIVATEERS KEEP RACING

1968–1982

Strictly speaking, at the start of the C3 era in 1968 GM was no longer bound to the 1957 AMA ban on manufacturer participation in racing. Even so, Chevrolet did not get overtly involved in the sport with a factory team. Instead, it continued doing what had been done since GM signed the agreement in June 1957, which is make available option packages suitable for racing, and support the more capable teams and drivers competing with Corvettes.

◀ To demonstrate the superiority of its new radial tires, B.F. Goodrich provided Greenwood Racing with Lifesaver T/A street radials shaved to half tread depth in 1971, and then in 1972 went head-to-head with Goodyear, which provided its street radials to Race Enterprises and Development for its Corvettes.

▶ Modified production C3 Corvettes, with fender flares, exceptionally wide tires, and massively powerful 427 engines, on the starting grid in IMSA's Camel 6-Hour GT at Mid-Ohio on September 7, 1972.

▼ Though high-level sports car racing was moving away from amateurs toward well-sponsored professionals by the early 1970s, most team members were still friends or weekend warriors, not full-time paid pros, and the pit equipment was quite rudimentary.

While even the fastest Corvettes of the 1960s were rarely a match for the much lighter Shelby Cobras and GT350R Mustangs, which took home most of the SCCA A- and B-Production national championships, Chevy's sports car still enjoyed tremendous success, earning numerous divisional championships and class wins at Sebring, Daytona, and other big races. This was due in part to Corvettes, Cobras, and Mustangs racing in different classes at times, and also the sheer number of Corvettes sold. Shelby American produced 2,000 GT350 Mustangs in 1965 and 1966; from February 1962 through March 1967, a total of 998 Cobras were made. From 1962 to 1967, Chevrolet built a total of 132,495 Corvettes. Add in the pre-1962 cars that were still racing throughout the 1960s—as well as the several hundred thousand more Corvettes produced in the late 1960s and 1970s—and the difference in scale was truly overwhelming.

Cobras were rarely seen as the 1960s wound down and the 1970s began, but Corvettes kept competing just about everywhere and continued dominating production-based GT racing. At the 1970 24 Hours at Daytona, Jerry Thompson and John Mahler drove their Owens-Corning–sponsored Corvette to a convincing GT victory and sixth overall. A small army of L88-powered Corvettes also dominated GT at Sebring in 1970, with Tony DeLorenzo and Dick Lang earning class honors in another Owens-Corning car. At rain-soaked Le Mans in 1972, perennial Corvette competitor Henri Greder and Jean-Pierre Rouget masterfully drove their ZL1-powered hardtop convertible to what would have been first in GT +5.0 and sixth overall, but they failed to complete enough laps in accordance with a rather convoluted formula tied to engine displacement, so the car wasn't classified.

The 1970 American Road Race of Champions (AARC) saw one lone Cobra in a sea of Corvettes. Allan Barker drove his Corvette to the B-Production national title, just as he had done in 1969 and would do again in 1971 and 1972. In A-Production, a brash young engine builder from Detroit named John Greenwood earned the first of his consecutive national championships with Corvettes.

IMSA RACING

Despite the appearance of business as usual in the early 1970s, drastic changes in the auto industry were taking place that would dramatically affect production-based racing. On January 1, 1970, President Nixon signed the National Environmental Policy Act. Later that year the EPA was created to implement the act's mandated 90 percent reduction in pre-1968 automotive emissions levels by 1975. This extraordinarily difficult requirement, in concert with equally onerous safety dictates and changing consumer expectations, profoundly changed the character of new cars, making them increasingly less suitable for racing.

It was in this climate that the International Motor Sports Association (IMSA) rose to prominence. Founded in 1969 by John Bishop and Bill France Sr., IMSA billed itself as "Racing with a Difference." Because it was not affiliated with SCCA, FIA, or any other sanctioning organization, IMSA wrote its own rules, which were quite liberal by comparison. While government requirements and the changing face of the auto industry made new Corvettes progressively less competitive—and the march of time and technology did the same to older ones—IMSA's rules allowed for considerable modification and innovation, paving the way for a new generation of production-based Corvette race cars.

IMSA initially established two classes, GTO for cars with engines over 2.5 liters and GTU for cars with engines smaller than 2.5 liters. With their massive 7-liter big-blocks, Corvettes were in a good position to dominate GTO, at least for the first couple of years. Don Yenko, Tony DeLorenzo, Jerry Thompson, Or Costanzo, Dave Heinz, both Bob Johnsons, Allan Baker, Doug Bergen, and John Greenwood all piloted thundering L88 and ZL1 Corvettes to class wins everywhere from Watkins Glen to Talladega.

In the early 1970s, competition heated up with the emergence of a tire war between Goodyear and B. F. Goodrich (BFG). As one of the first tire makers to bring radials to market, BFG's management was so confident in their performance that they decided to pit street radials against purpose-built racing tires. At the 1971 IMSA endurance event

▲ At rain-soaked Le Mans in 1972, perennial Corvette competitor Henri Greder and Jean-Pierre Rouget finished sixth overall, behind three Porsche and two Ferrari prototypes, but their 427-powered convertible was not classified because it didn't complete enough laps according to a formula tied to engine displacement.

◀ After discussing its merits with John Greenwood, Zora Duntov asked Randy Wittine and Jerry Palmer to design a wider version of the production Corvette body. The result was a radical wedge shape that wrapped around the chassis and generated extreme levels of downforce.

▼ In 1973, after IMSA replaced the FIA as the sanctioning organization for Daytona, Sebring, and several other major events, considerably more expansive rules allowed for larger-displacement engines, wider wheels and tires, and extensive body modifications, leading GM to work with John Greenwood to create wide body Corvettes.

on Michigan International Speedway's "roval," Greenwood and "Marietta Bob" Johnson won with a Corvette wearing Lifesaver T/A street radials shaved to half-tread depth, setting the stage for Goodyear to enter the fray the following year. For 1972 BFG sponsored a two-car effort by Greenwood while Goodyear signed on with Race Enterprises and Development (RED), an outfit formed by Or Constanzo's team manager Toye English and his son Dana.

Goodyear won the opening rounds, with RED notching GT victories at Daytona (a race shortened to six hours that year) and Sebring. The battle continued across the Atlantic, with RED and Greenwood vying for victory at Le Mans. Both teams, as well as those piloting the other Corvettes entered in the French classic, experienced a wide range of problems. RED's No. 4 Corvette, driven by Yenko and Marietta Bob, was the sole Corvette to finish, albeit only seventh in GT.

The radial tire war infused much-needed money into GT competition and was one more step in the transition from mostly privateer to mostly professional racing. A far larger injection of money came from R. J. Reynolds Tobacco, which became a major sponsor of IMSA in 1972.

At the end of 1972 Corvettes shone once again. Jerry Hansen won the SCCA A-Production championship in one of Jerry Thompson's old Owens-Corning cars, while Allan Barker earned another B-Production title in his LT1-powered Corvette. With wins at Virginia and Lime Rock and several top-ten finishes, "Fast Phil" Currin bested better-funded, big-block-powered Corvettes to win the IMSA GTO championship in his 10-year-old 1963 coupe.

Corvettes continued dominating SCCA racing for the next few years, with A-Production national titles going to J. Marshall Robbins in 1974, Frank Fahey in 1975, and Gene Bothello in 1976. Bill Jobe won back-to-back B-Production national championships in 1973 and 1974. It was a different story in IMSA competition: Corvettes were increasingly less competitive after Currin's championship in 1972. Recognizing this, IMSA permitted progressively more radical modifications and in large measure the SCCA and FIA followed suit.

THE WIDE BODIES

In 1973 Corvette Chief Engineer Zora Duntov asked GM designer Randy Wittine to create an aerodynamically efficient wide body for Corvettes. The idea reportedly came to Duntov from Greenwood after he won a Trans-Am race at Road America, on his way to winning the 1973 Trans-Am manufacturer's championship for Chevrolet.

Taking full advantage of every single word, both in and absent from the new rules book, Wittine worked with Jerry Palmer to design a radical wedge-shaped Corvette body that wrapped around the chassis and generated extreme levels of downforce. A company called Diversified Glass was contracted to deliver several prototypes to Chevrolet, subsequently putting them into production under contract to Greenwood and his brother Burt, who sold them in kit form or as completed cars for racing and street use.

Changes under the fiberglass were just as radical as the wide bodies themselves. Bob Riley designed completely new, highly sophisticated anti-dive front and anti-squat rear coil-over suspension systems that dramatically improved Corvette's handling and stability at high speeds. Larger, more powerful engines complemented the high-downforce wide bodies, fabricated suspensions, and complex roll cages that dramatically stiffened the chassis. IMSA imposed no limit on engine size, so Greenwood and others took advantage of the Chevrolet powerplants created for the unlimited-displacement Can-Am series. Gary Pratt, later to gain fame as team manager for the factory Corvette Racing program

▶ John Greenwood was the promoter of the 12 Hours of Sebring in 1975 and 1976. His wide body Corvettes were used to advertise the race.

launched in 1999, and Charlie Selix fabricated a cross-ram manifold that enabled Greenwood to mount a Kinsler-modified, Lucas side-draft fuel-injection system on a big-inch Chevrolet engine. The resulting engine was extraordinarily powerful and responsive and, thanks to the Pratt/Selig manifold, it fit beneath the Corvette's hood.

The wide body Corvettes were extremely fast from the start, but teething troubles kept them out of the winner's circle until Milt Minter won the 1974 Bama 200 at Talladega in a Greenwood-built car. At Road America in August, Greenwood broke the track record in qualifying and handily won the race. At the IMSA season-ending Daytona 250 in November, Greenwood again earned pole position and won the race, finishing a full lap ahead of the second-place Porsche Carrera RSR.

Greenwood sold complete wide body Corvettes and the parts needed to build them to other racers, including Tony DeLorenzo and Dave Heinz. Greenwood Racing also continued development of the wide body cars, which over time became more radical. By 1975, parts of the stock Corvette chassis were still present, though they were now integrated into a Bob Riley–designed tubular space frame. The wide bodywork generated excellent downforce and housed massive racing slicks. Wilwood Grand National–style brakes, sized to haul down stock cars weighing 1,500 pounds (680.39 kilograms) more than a stripped Corvette, were fitted at all four wheels. Engines were set back for better balance and lowered considerably after stock oil pans were replaced with dry-sump systems. Powered by Can-Am–derived, Kinsler/Lucas-injected aluminum-block 467 cubic engines that made close to 700 horsepower in endurance trim and over 900 horsepower in sprint form, these were fearsome machines that handled well, stopped well, and could achieve speeds in excess of 230 miles per hour (370.15 kilometers per hour) at some circuits, including Le Mans and Daytona.

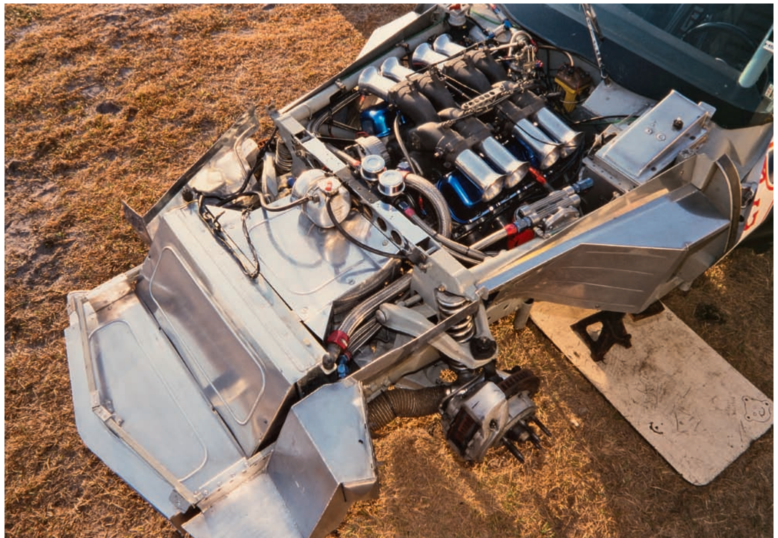
Despite the incredible speed of the wide bodies, which produced many track records, pole positions, and fast race laps, they remained relatively fragile and failed to finish more often than not. This, combined with their awful fuel economy, made them no match for the Porsche RSRs and BMW CSLs that came to dominate GTO racing by the mid-1970s. IMSA created a new All American Grand Touring (AAGT) class in 1976, and John Paul managed to squeeze out a championship there for Corvette two years later. At this point, however, Corvette was not in the same class as the thoroughly dominant Porsche 935s (in the newly formed GTX class) and the older RSRs and CSLs (in GTO), which meant Corvette was no longer competing against them.

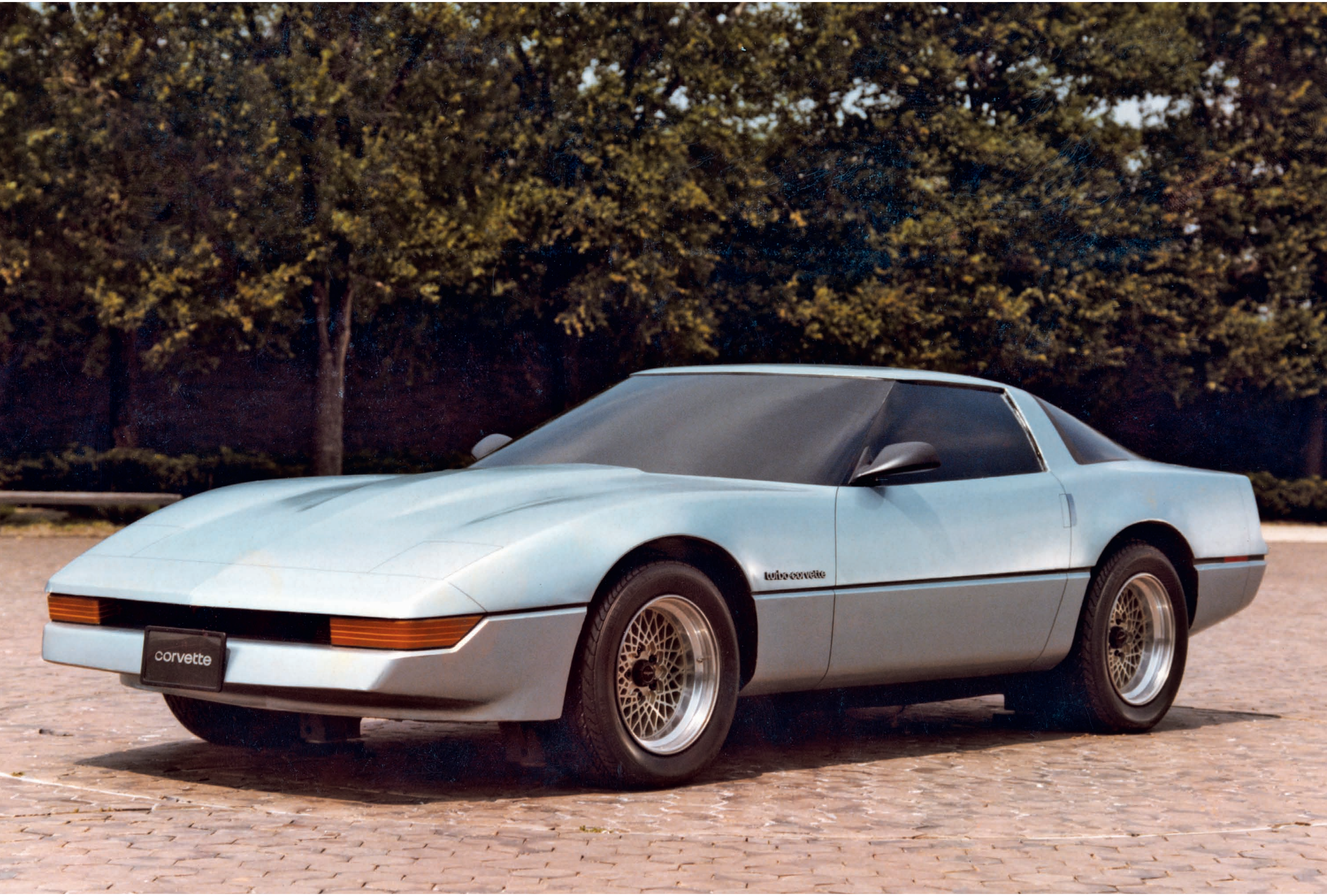
As the decade wound down, Corvettes remained competitive in the mostly amateur SCCA A- and B-Production classes. They also did well in Trans-Am, with Greenwood (1975), Gregg Pickett (1978), and Gene Bothello (1979) winning championships. By the end of the 1970s, however, even the best of them were used-up relics in top-level production-based categories. It would take a completely redesigned fourth-generation Corvette to put America's sports car back in the winner's circle at the highest levels of GT racing.

▲ John Greenwood, captured momentarily relaxing at Sebring in 1976, was one of the most innovative and talented drivers, fabricators, and team owners racing Corvettes in the C3 era.

◀◀ The interior of this Greenwood wide body Corvette race car, stripped of all nonessential components and fabricated with sheet metal, bears no resemblance to a stock C3.

▼ Traces of the stock chassis and front suspension are still visible in this Greenwood wide body Corvette, fed by a brutally powerful Kinsler/Lucas-injected big-block Chevrolet engine.




corvette
turbo corvette

15

A NEW LEASE ON LIFE

C4 INTRODUCTION, 1984

In the early 1970s, when work should have begun on the fourth-generation Corvette, Chevrolet engineering was devoting virtually all its resources to meeting the continuing cascade of federal and state emissions, safety, fuel economy, and noise regulations. Corvette's sales had been strong year after year during the 1970s, even in the face of falling performance and rising prices, so GM's top management was in no hurry to invest in a new car. Why spend millions designing a new Corvette when the old one set new sales records almost every year, and delivered healthy profits, especially at a time when many of GM's other vehicles were faltering?

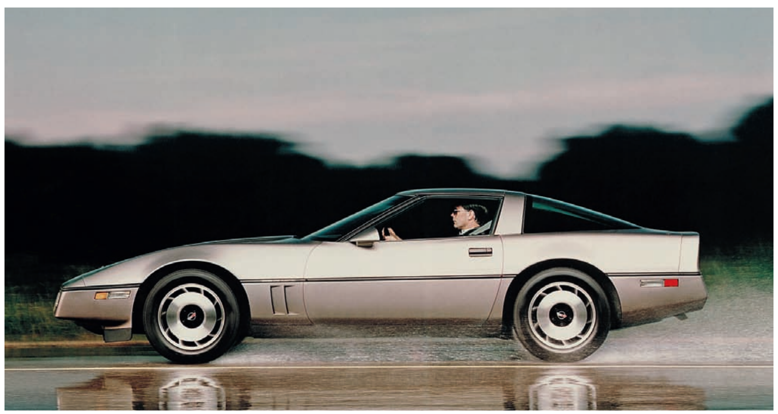
◀ With Specialty Vehicles Incorporated under contract to assemble sixteen twin-turbo prototype C4s for Chevrolet beginning in 1983, Chevrolet's designers devoted a lot of time to styling a potential turbocharged Corvette.

MID-ENGINE V-6?

When work did finally get underway in 1979, it was unclear what the next-generation Corvette would look like. What *was* coming into focus was the threat of various forces to fundamentally change the character of America's sports car. In response to the lasting impact of the Arab oil embargo of 1973 and 1974, GM dramatically downsized all of its cars, and for a time there was a push to do the same with Corvette. To that end, Dave McLellan's Corvette engineering group and the Chevy III styling studio, led by Jerry Palmer, studied the feasibility of a mid-engine V-6 Corvette.

Such a configuration would have taken advantage of the transverse V-6 powertrains already in development for the GM X-cars, introduced in 1980, and J-cars, unveiled two years later. Though smaller and about 300 pounds (136.08 kilograms) lighter than a late-1970s small-block V-8, GM's 2.8-liter V-6 produced only 115 horsepower and 145 lb-ft (215.78 kilogram-per-meter) torque in its initial production configuration. Power output could be increased substantially with forced induction, but the transaxles being developed in conjunction with the new V-6 had no additional torque capacity, so they wouldn't work with a more powerful turbocharged engine. As a result, the engineering group rejected the V-6 for use in a mid-engine Corvette.

Though the V-6 was off the table, this alone did not remove mid-engine architecture from consideration. There were, however, numerous other engineering factors weighing against it. One was crashworthiness, which was difficult enough with increasingly more stringent standards, and made exponentially more difficult when the mass of a large V-8 was placed behind the occupants of a vehicle and the space ahead of them was consumed by the fuel tank, steering system, and other necessities.



▶ Because it replaced a car that was engineered more than twenty years earlier, the C4 represented a tremendous advance in every aspect of performance when introduced as a 1984 model.

Packaging was another serious impediment to a mid-engine layout. The structure, engine, drivetrain, rear tires, and suspension would consume almost all space behind the occupants. The fuel tank, steering, braking system, front tires, cooling system, air conditioning, and a long list of other necessities would take up virtually all of the space ahead of the occupants, leaving almost no storage space. This didn't deter exotics that made no pretense of being practical, but Corvette was always a car that could stand shoulder-to-shoulder with most exotics in terms of real performance, while at the same time serving as a car that owners could legitimately drive every day. McLellan's group was committed to keeping it that way.

Technology would eventually overcome these issues, which underscores the fact that a mid-engine Corvette could have been brought to market in 1984 if GM's top management had wanted it. As before, however, GM's leadership, including Bob Stempel, engineering director of Chevrolet from 1977 to 1980 (later general manager of Chevrolet, president of GM, and chairman of the board of GM); Lloyd Reuss, who replaced Stempel as general manager of Chevrolet; Don Runkle, director of Chevrolet market planning; Roger Smith, who became GM's chairman in 1981—these men, along with other members of GM's product policy group, didn't see any compelling reason to take Corvette in a radical new direction.

ENGINEERING THE C4

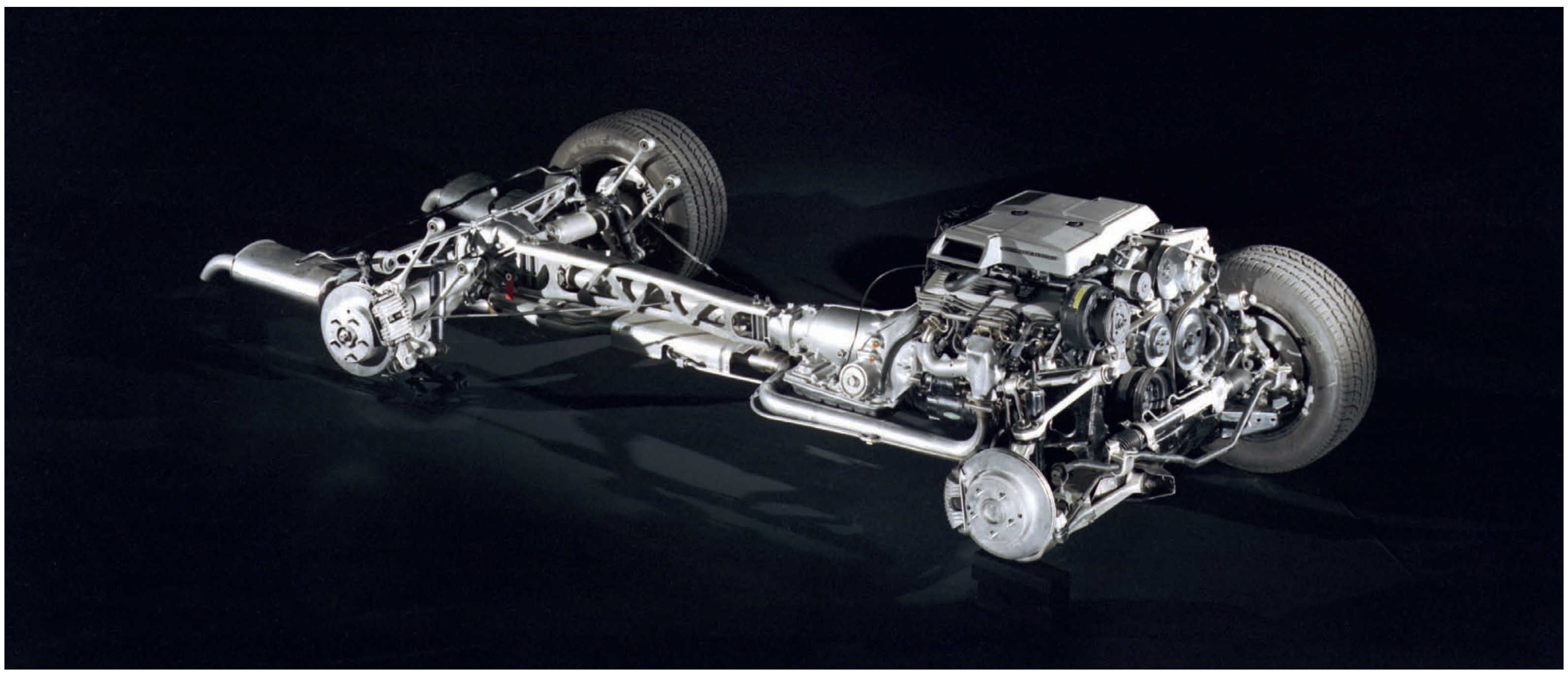
Once the decision was made to retain Corvette's traditional layout for the C4, those responsible for creating the new car got to work. It's worth noting that the entire process was under the control of Chevrolet, which was the exception by the late 1970s. From GM's beginning through the 1960s, each division produced its own vehicles in their entirety, but by the early 1970s this was no longer the case. In an effort to cut costs and maximize profits by eliminating redundancy, divisions shared engines, transmissions, electrical components, fuel systems, and, eventually, even entire platforms. This homogenization applied to all but two GM vehicles of the era, Corvette and Pontiac's Fiero. And while some responsibility for the highly unusual Fiero was spread among GM groups outside Pontiac, Corvette remained entirely underneath Chevrolet's umbrella.

Approximately thirty-five people comprised the Corvette engineering group, with another nine engineers assigned to the group for C4 development. Engineering support came from various other GM divisions, including Delco Remy, Guide Lamp, Harrison, AC Spark Plug, Rochester Products, and GMAD. And, as always, numerous outside component and service suppliers, including Goodyear, Bosch, Dana, and Detroit Industrial Engineering, contributed to the process and provided engineering support.

From early on it had been decided that the new Corvette would retain its reinforced plastic body on a separate frame, but now McLellan foresaw the potential to dramatically improve upon the C3 chassis, a twenty-year-old design. Throughout the 1970s, the science of chassis design ramped up to meet tougher regulatory requirements and increasing consumer expectations.

Equally important were innovations in tools and techniques. The first Corvette chassis was designed the old-fashioned way, with men working on drafting tables using slide rules to make complex calculations. The creation of the second-generation chassis was hardly any different, with only minimal use of rudimentary computers to aid the process. By 1979 everything had changed, and McLellan's team was at the cutting edge, ready to take full advantage of all the new technologies.

Engineer Brian Decker left Chevrolet Research and Development's analysis group to lead the effort to develop the concept for the new Corvette's structure. He and his colleagues, including Ronald N. Burns and Robert A. Vogelei, had to satisfy numerous conflicting objectives, including increasing structural stiffness, reducing mass, enhancing interior space, and meeting all federal crashworthiness requirements. To accomplish all these, Decker reached out



◀ The C4's central C-shaped backbone that extended from the transmission to the differential, developed by Chevrolet R&D's Al Bodnar, helped strengthen the new car's structure.

to two groups for assistance. For help achieving the required strength and stiffness goals he contacted GM Research Laboratories (GMR), which was capable of applying advanced analytical optimization techniques to the task. And to ensure that the new Corvette complied with all applicable crashworthiness regulations, he went to Grumman Aircraft Company, whose sophisticated plastic deformation analysis capabilities could be directly applied to evaluating the crashworthiness of an automobile chassis.

GMR was tasked with finding the minimum dimensions and mass of the chassis structure that met the defined strength and dynamic stiffness goals, along with the limitations imposed by the overall body design and dimensions. Powerful computer modeling enabled GMR to work its way mathematically through many possible solutions, in so doing dramatically reducing the cost and time required to obtain the needed information. GMR's results were applied to the finite-element model of the chassis structure McLellan's team had constructed, yielding the most mass-efficient solution.

Concurrent with the work GMR and the chassis engineers were performing, Grumman looked at how the proposed structure would behave in a severe crash. Underlying the principle of crashworthiness is the fact that the kinetic energy of a serious car crash can be significantly diminished by structural deformation. Expressed another way, when an impact's energy is absorbed by the buckling of a car's structure, that energy does not reach the occupants, thereby reducing the likelihood of injury to them.

One way to determine how much impact energy a structure will absorb during deformation is to run it through a crash test. Crash testing is time-consuming and expensive, especially when multiple tests are required to find the best solution. Another option is to model structural deformation on a computer, which sounds simple enough but is extraordinarily complex when great accuracy is needed. In 1979 GM did not have the capacity to compute the linear stresses and strains in a finite-element model, but Grumman did.

On behalf of the United States military, Grumman was studying ways to lessen the consequences for crew members when a helicopter suffered a vertical crash. It was obviously unacceptable to keep dropping helicopters out of the sky to test every theoretical impact, so Grumman scientists developed techniques for large-scale computational analysis of nonlinear elements that could deform to absorb the energy of impact. To perform the immense computations that were required to accurately predict outcomes, the company invested in a $9,000,000 Cray-1 supercomputer that was capable of 160 million floating-point operations per second. That sounds fast, and it was for the time. Even so, the Cray-1 had to work around the clock for several days to simulate a single crash event. (It is notable that today's HPE Cray EX supercomputer is six billion times faster than a Cray-1.)

Grumman's analysis indicated that the proposed Corvette structure's front rails would deform at a rate that would meet federal government crash test requirements. Later scale-model crash tests reinforced the validity of Grumman's calculations and ultimately full-size crash testing of a complete car confirmed the accuracy of both the Grumman analysis and scale-model crash test program.

The final C4 chassis design effectively combined a perimeter frame with an upper structure into one welded unit. High-strength, low-alloy (HSLA) steel, which has superior strength-to-weight compared with conventional mild steel but is more difficult to form and weld, was used for the front and rear rails and roof bow. This, along with elimination of a central crossmember underneath the passenger floor, resulted in the chassis weighing only 350 pounds (158.76 kilograms).

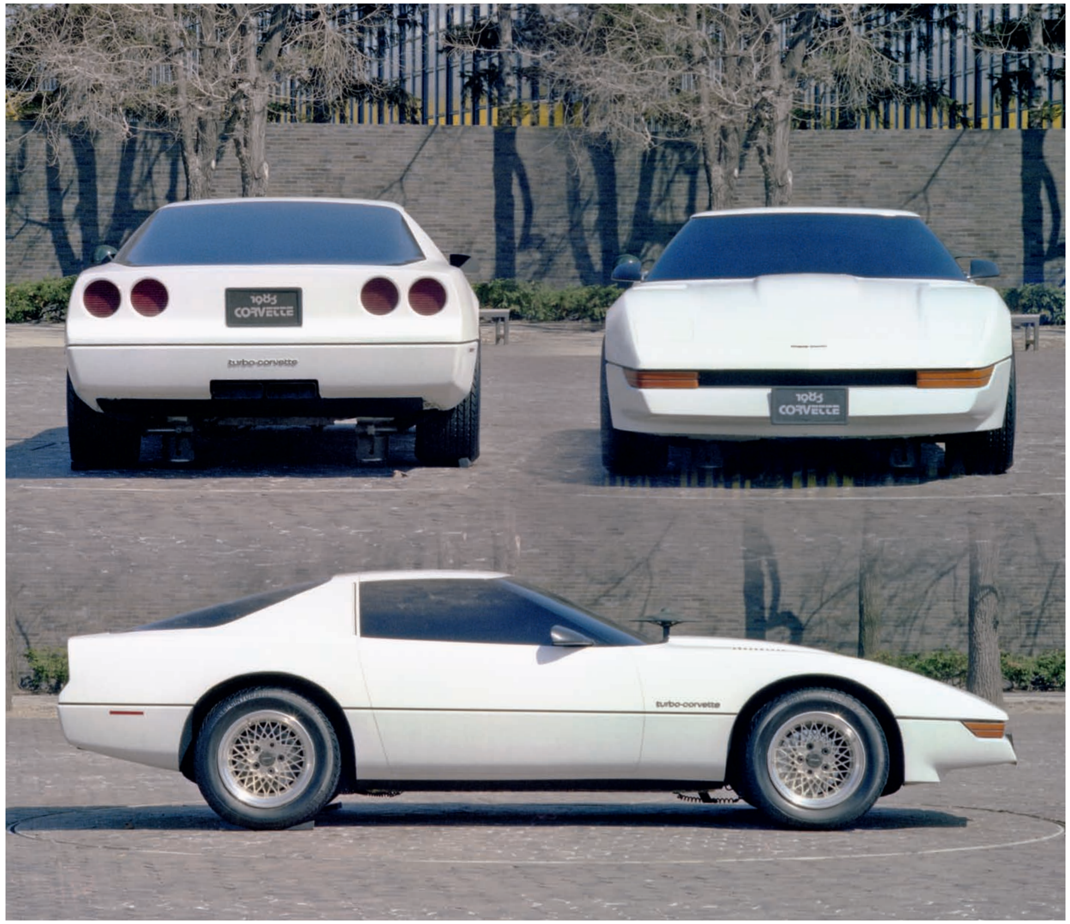
The absence of the central crossmember enabled designers to lower the floor, creating more interior space. To provide a rear transmission mount in the absence of the crossmember, Al Bodnar of Chevrolet R&D developed a central C-shaped backbone that extended from the back of the transmission to the differential.

About a year after work on the new Corvette began, most engineering and design parameters were nearly finalized and the build of six pre-prototype C4s was authorized. These cars were to serve as development tools for ride, handling, and structural analysis. The budget was reduced after the first three cars were completed, making it impossible to build the other three. Even without the budget cut, though, the additional three pre-prototypes would not have been built, owing to Chevrolet General Manager Lloyd Reuss' direction to replace the planned T-top roof with a Targa roof, thus eliminating the central bar between the windshield frame and rear roof support. This was strongly supported by the designers, who considered T-tops outdated, but Corvette's engineers were appalled: the central bar that would go between the T-tops was integral to chassis strength. Its removal significantly weakened the overall structure, so they had to find ways to regain the lost stiffness.

The first thing the engineers did was raise the rocker sills substantially. This helped, but the car was still too flexible. Equally troubling, the high rockers made entering and exiting the car more difficult for some people, leading to complaints from customers and the automotive media in years to come. To further stiffen the structure, the engineers added reinforcements to the front rails and, together with the higher sills, this was enough to raise the structural frequencies above wheel hop so long as the Targa roof was in place. With the roof removed, however, the first torsion mode was below wheel hop, which is to say that structural body vibration frequencies were below wheel hop. When the car was traveling over rough roads with the roof off, there would be enough deflection, distortion, and twist in its structure to cause noticeable vibration, noise, harshness, and, in extreme cases, some steering via the suspension changes. A change from Delco dual-tube gas-bag shocks to Bilstein high-pressure monotubes with stiffer mount bushings reduced but did not eliminate the problem. Subsequent years saw improvements by virtue of suspension and tire innovations as well as the use of electronic chassis controls, but this issue was never eliminated entirely.

A sophisticated new suspension, which made extensive use of aluminum forgings to minimize mass, complemented the C4's chassis. Thanks largely to the widespread use of the light alloy for everything from control arms to spindles, the 1984 front suspension weighed 58 percent less than its predecessor. The geometry of the C4's twin-wishbone front suspension gave it anti-dive properties and the new five-link rear suspension delivered anti-squat characteristics. A light and precise rack-and-pinion steering system replaced the recirculating ball setup that had been used before, and the C4 had transverse fiberglass monoleaf springs front and rear.

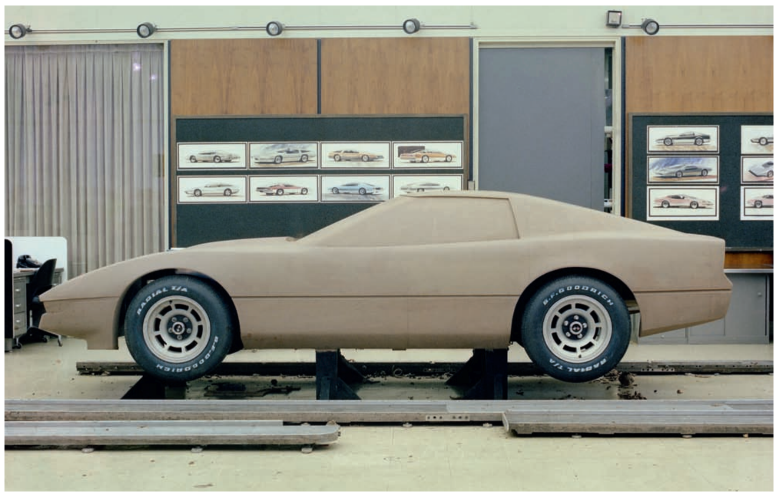
The C4 used four-wheel disc brakes, a Corvette staple since 1965. As with everything else, though, McLellan's team sought to minimize the system's mass. For help with this, they turned to Girlock, an Australian-based joint venture of Girling and Lockheed. The resulting system used single-piston aluminum calipers that reduced both mass and parasitic drag.



▲ The overall shape of this design study, which contemplated a turbocharged C4, is close to final production.

▶ Some C4 exterior designs were rendered in full-size clay models, using a computer-controlled cutter as well as hand tools.

▼ Full-size clay study is very close to production C4 but differs somewhat by virtue of slightly shorter front overhang, slightly longer rear overhang, and concave front fascia.



POWERING THE C4

The 350-cubic-inch (5,735.47cc) engine used in 1982, complete with its Cross-Fire Injection, carried over to the C4 largely unchanged. The underlying engine was extraordinarily reliable, powerful, and economical to build and operate. With roots going back to the first Chevrolet V-8 introduced in 1955, the engine could remain as it was, especially when so much time, effort, and money was being devoted to the rest of the car. The one weak point that would have benefited from a change, however, was the Cross-Fire throttle body injection setup.

For the Porsche 928 and other cars, Bosch had already brought its far superior port fuel-injection system to market, but GM management was still hopeful that Cross-Fire Injection could be sufficiently improved. Unfortunately, their stubbornness was driven, to some extent, by the troubled relationship between Cadillac and its fuel injection supplier, Bendix. The disastrous 1981 Cadillac Modulated Displacement Engine, more commonly known as the V8-6-4, used Bosch port fuel injection supplied by Bendix, which at the time was the exclusive North American distributor for Bosch injection systems. Roy Midgley, who led the V-8 engine group, and his team were tasked with making the most of Cross-Fire Injection until GM's difficulties with Bendix could be ironed out.

The problems with Cross-Fire Injection, most notably its poor fuel economy, complicated the choice of transmission for the C4. The 700R4 four-speed automatic introduced in 1982 carried over to 1984, and C4s equipped with it barely avoided the $500-per-car gas-guzzler penalty, incurred when a car couldn't achieve 19 miles per gallon (8.079 kilometers per liter) in the EPA's test. A 1984 fitted with a four-speed manual would deliver 2 miles per gallon (0.85 kilometers per liter) fewer than the automatic, thus triggering the gas-guzzler penalty; this was not acceptable to Chevrolet. That aside, the last four-speed manual available as an option for Corvette in 1981 was a BorgWarner T10, a transmission that was no longer being made when 1984 production began.

The solution to the manual gearbox dilemma was a hybrid transmission supplied to Chevrolet by Doug Nash Engineering, consisting of the old BorgWarner–designed four-speed manual coupled to a computer-controlled three-speed overdrive. The overdrive unit was essentially an automatic transmission that added an overdrive gear to the manual's second, third, and fourth gears, improving the C4's fuel economy by about 1.5 miles per gallon (0.639 kilometers per liter), which was enough to avoid the gas-guzzler penalty.

STYLING THE C4 BODY

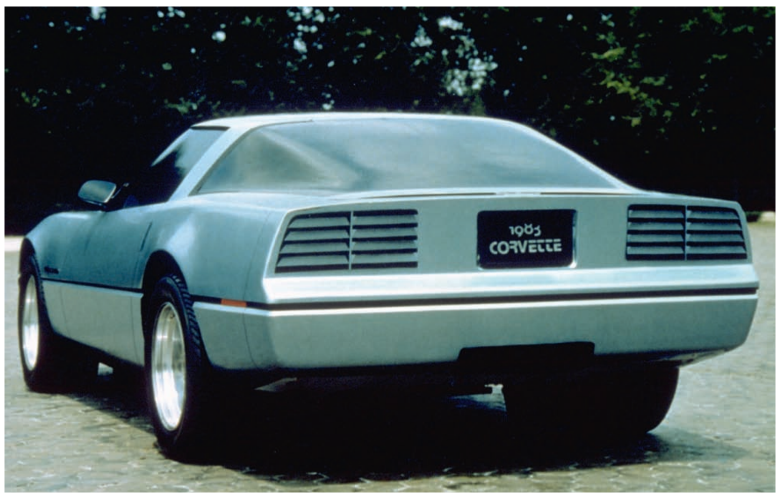
While McLellan and his small army of engineers were confronting their long list of challenges, the stylists in Chevrolet's Studio III, which handled Corvette design, were doing their part to bring a new Corvette to life. Under the leadership of GM Styling head Chuck Jordan, Jerry Palmer took over as the lead of the new Corvette's design team.

Palmer had joined GM immediately after graduating from the College of Creative Studies in 1966 and was appointed chief designer of Studio III in 1974. It was there that he created the *Aerovette*. This beautiful car, more than any other, had served as the design inspiration for C4.

Palmer's immense talent and previous history with Corvette were critical for success, but there was another factor that made him the ideal choice to lead C4's design team, and that was his relationship with McLellan and the Corvette engineering group. In a critical break from the past, when by sheer force of personality GM design bosses Harley Earl and then Bill Mitchell dominated every aspect of Corvette, including to some extent even its engineering, Palmer thoroughly collaborated with the engineering team. This was due in large part to Palmer's friendship with McLellan and the mutual respect the men shared for one another. The improved working relationship between design and engineering also reflected the far more reserved nature of Irv Rybicki, who was appointed to lead GM Design following Mitchell's retirement in 1977. Even more important, however, was the central importance of engineering that came with exponentially advancing technology and the need to meet the onslaught of governmental emissions, fuel economy, safety, and noise mandates. Even absent the subdued leadership style of Rybicki and the genuine friendship between McLellan and Palmer, the time when design could utterly dominate the creation of a new car had disappeared for good.

As a Corvette enthusiast, Palmer understood the value of tradition to the car's buyers, so he set out to create something that was bold and beautiful, yet familiar. Inspiration for boldness was furthered by an opportunity that grew out of the advanced crash deformation analysis Grumman was conducting for Chevrolet. Arthur August, the aerospace company's project manager for its Chevrolet contract, invited Corvette engineering and design leadership to visit Grumman's Calverton, New York, flight test center. There, Palmer and the others got up close and personal with an F-14A Tomcat, America's premier carrier-based supersonic fighter plane of the era.

As with all jet fighters, every inch of the F-14A Tomcat's exterior surface is uncompromisingly purposeful, with a hyperaggressive shape that is also flowing and beautiful. Drawing on the incredible experience of seeing this plane in person, and

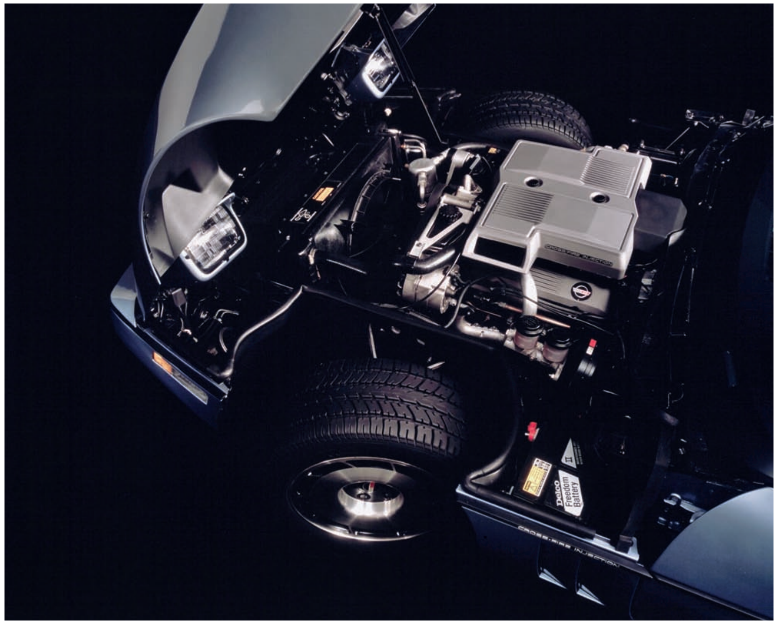


◀ This C4 design study used unusually large, louvered taillamps.

▼ This early C4 design study shows the influence of the *Aerovette*, but with a Kamm tail rather than the show car's dramatically tapered rear.

▶ John Cafaro designed the C4's clamshell hood, which tilted forward as a single unit, giving excellent access to the engine compartment and front suspension and eliminating all body panel bonding seams in the nose.

▶▶ C4 design team leader Jerry Palmer adds a mirror surface to the Targa top on a full-size clay model.



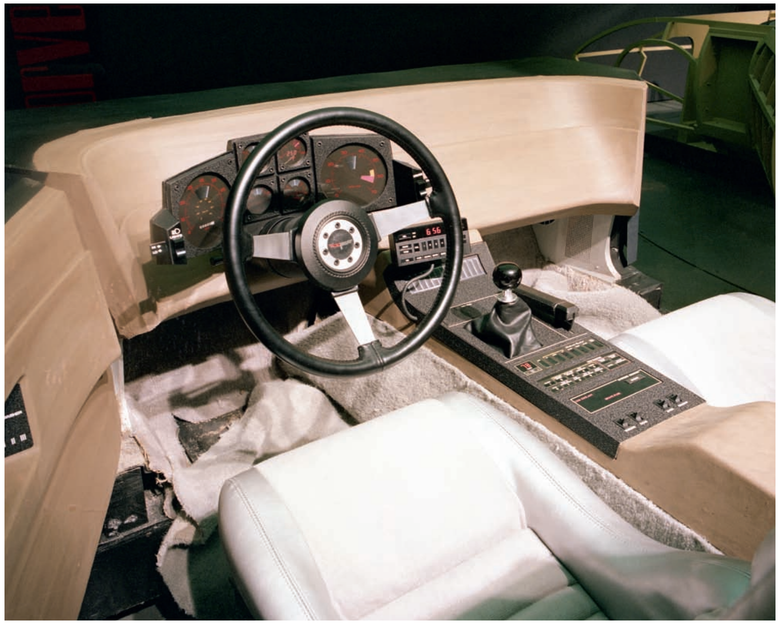
with the *Aerovette* present for reference in Studio III, Palmer and his team began designing the body for C4. Sketches became progressively more detailed and then the result was sculpted from clay, both in full scale to judge its design and in quarter scale for wind tunnel evaluation. GM's own full-size wind tunnel was under construction at the time, so the aerodynamicists would have to rely on the GM Tech Center's quarter-scale Harrison tunnel for initial evaluations.

Reducing fuel consumption and emissions was essential, making aerodynamic performance far more important in the design of C4 than it was for previous Corvettes. Following quarter-scale evaluations in the Harrison facility, extensive full-scale testing was conducted at Lockheed's subsonic wind tunnel in Marietta, Georgia. Though "slow" by aerospace standards, this facility could test in wind speeds up to 200 miles per hour (321.87 kilometers per hour), so it more than met the needs for C4.

The *Aerovette*'s influence on C4 design is apparent in the surface flow of its nose and steeply raked windshield, which is set back 65 degrees, but the new Corvette differed sharply from the experimental car in one notable way. Instead of the *Aerovette*'s dramatically tapered tail, which mirrored its front end, the production C4 got a "Kamm" tail, so named for Swiss aerodynamics pioneer Dr. Wunibald Kamm. The work of Dr. Kamm demonstrated that, contrary to most people's assumptions, a long, tapered tail increases overall drag compared with an abruptly terminated one.

Interestingly, the C4 Kamm tail was reminiscent of the Corvette taillamp panel used from 1968 to 1973, before C3s got an impact-absorbing, urethane-covered rear bumper. Round taillamps and hideaway headlamps were two more styling elements that tied the new Corvette to its ancestors, going all the way back to 1963 for the headlamps and 1953 for the taillamps. The C4's rear window treatment, though high-tech insofar as it was the largest compound-curved window on any American car—and functional in that it opened up to give easy access to the rear passenger compartment—was also, in terms of overall shape, evocative of the 1963–1967 and 1978–1982 coupes.

One important exterior design element that deviated from tradition was the break line between the new body's upper and lower halves. This clever feature was created by



◀◀ This fully trimmed C4 interior buck helped designers refine the ergonomics and aesthetics of the production car's cockpit.

◀ This C4 interior design proposal captures the basic layout that made it to production, but virtually every detail was different.

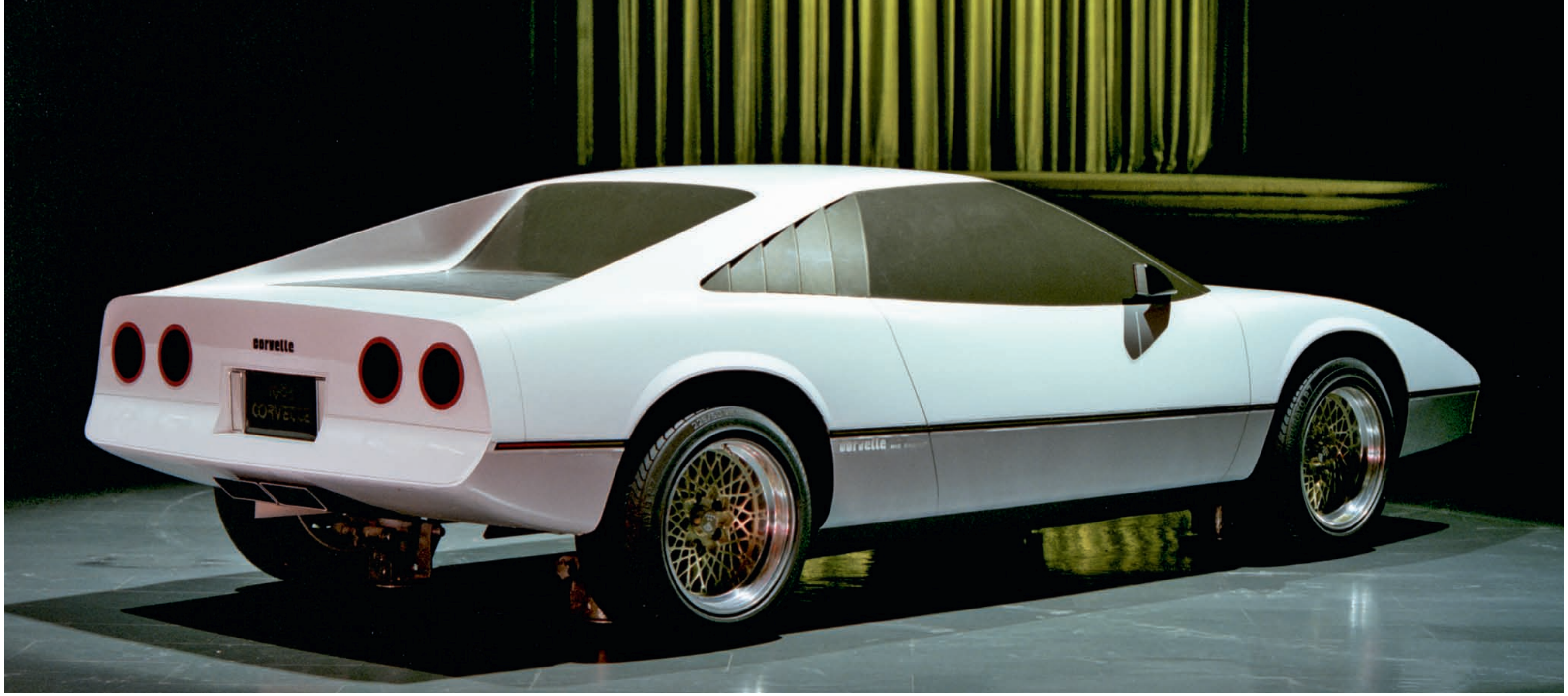
the talented designer John Cafaro, who would later lead the Corvette studio for C5 and serve as executive director of global Chevrolet Design for C7 and C8. Cafaro's design allowed for an integrated hood and front fender assembly, providing excellent access to the engine compartment and front suspension and eliminating all body panel bonding seams, which were labor-intensive to finish and a frequent source of defects in all earlier Corvettes. Cafaro credits Lloyd Reuss with giving him and his Styling colleagues the freedom to do innovative things with the body, and for pushing everyone to make C4 a better car.

"Lloyd was responsible for a lot of the improvements to C4," Cafaro remembers, "including the clamshell hood, the tumbling headlights in the hood, and going to 16-inch (40.64-centimeter) wheels. He was also responsible for replacing the T-tops with a Targa top, and I know engineering didn't like that, but it was crucial that it be done. T-tops were outdated and a big part of Corvette's reputation as a 'disco-mobile,' not a world-class performance car. We had to get away from that look and without Lloyd pushing them the engineers would never have done it."

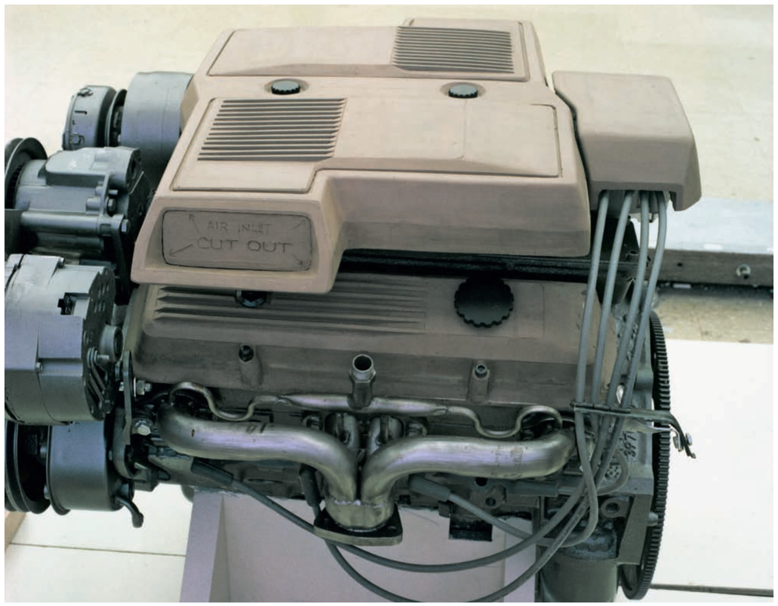
STYLING THE C4 INTERIOR

Concurrent with exterior styling, a small team of designers, led by Stan Wilen, were busy creating an interior for the new Corvette. Wilen and Bill Scott were part of the group that saw the F-14A Tomcat at Grumman's Calverton facility, and both were awestruck by the complexity, functionality, and sheer beauty of the fighter plane's cockpit. A direct impact of Scott's visit to Grumman was his design for the new Corvette's flat-panel LED displays. In emulation of the Tomcat's displays, they incorporated multicolor bar-graph and numerical indicators simultaneously. The displays, made for the new Corvette by AC Spark Plug Division, were not particularly popular with buyers or the motoring press, who clamored for traditional analog instruments, but there's no denying the high tech feel they gave C4.

The LED displays were not the only point of contention in C4's interior. The quality of materials and overall fit and finish, long a source of buyer dissatisfaction, was still not where most thought it should be. Some also criticized the large, rectangular protrusion on the passenger side dash, which housed a federally mandated passive restraint system.



▲ By the late 1970s GM was downsizing almost all of its cars and there was pressure to do the resulting creation of this design study. However, the low torque capacity of the transaxles under development for the GM X- and J- cars made them unsuitable for Corvette, effectively eliminating the mid-engine V-6 from consideration.



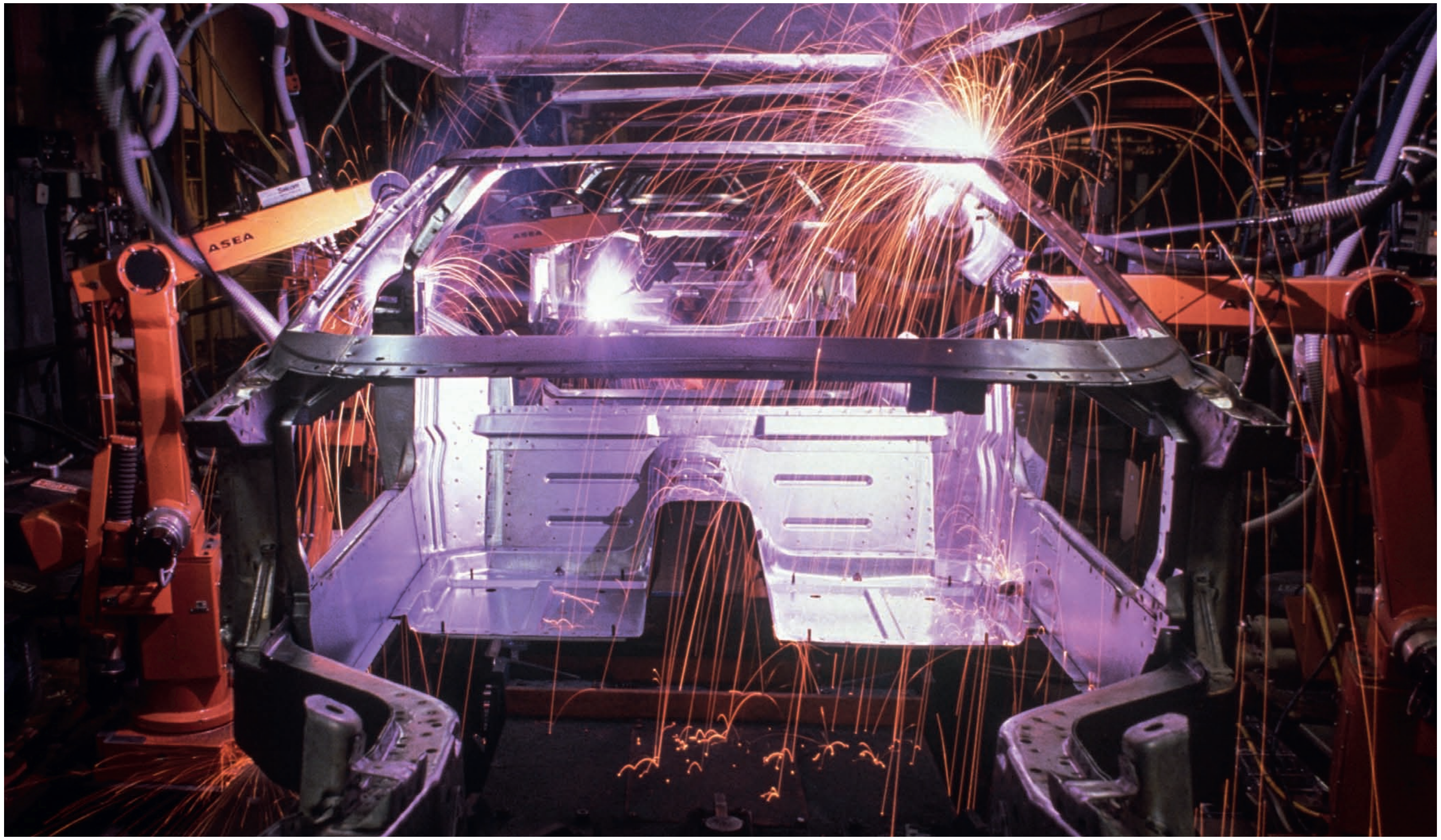
▶ The same 350 V-8 used in 1982 carried over to the C4, but packaging considerations and aesthetics induced a redesign of the Cross-Fire Injection air cleaner housing and several other components.

THE FINISHED CAR

When it was completed, the C4 Corvette fell short of some initial objectives but exceeded others. With an eye on lowering mass, which would improve every aspect of performance, McLellan's team was striving for a curb weight of 3,000 pounds (1,360.78 kilograms). The finished vehicle fell short of the mark: with its fuel tank full, a 1984 Corvette weighed 3,192 pounds (1,447.87 kilograms). Though heavier than they had hoped for, this was still an impressive 150 pounds (68.04 kilograms) less than a 1982 Corvette.

In terms of aerodynamic performance, the 1984's 0.34 drag coefficient, near-zero lift, and excellent front–rear balance far outperformed any Corvette that had come before, and equaled or surpassed any other production car of the period. The new Corvette's handling and braking performance were also equal to or better than any production car, even exotics like the Lamborghini Countach and Ferrari 308 GTSi that cost three or four times as much. The new P255/50VR16 Goodyear tires mounted to handsome 16-inch (40.64-centimeter) aluminum wheels played a major role in the car's handling and braking capabilities.

Though held back by its Cross-Fire throttle body injection and a long list of emissions and fuel consumption requirements, the engine group still managed to coax 205 net horsepower from the 1984's 350 V-8. While this set output right around where it had been for Corvette's base engine going back to 1966, it still represented a change in the right direction compared with horsepower in later C3s. And even with only 205 horsepower, the new Corvette managed to accelerate from 0–60 miles per hour (0–100 kilometers per hour) in under 7.0 seconds, traverse the quarter mile in a click over 15.0 seconds, and reach a terminal velocity of 142 miles per hour (228.52 kilometers per hour).



▲ Much, but not all, of the C4's body and chassis structure were welded by robots in the Bowling Green assembly plant.

Of course, the final arbiter of a production car's performance and other qualities is the customer, and by that measure the fourth-generation Corvette was a resounding success. Because the new car was ready for production in the middle of the 1983 model year, and it met all 1984 federal requirements, Chevrolet General Manager Robert Stemple decided to introduce it as a 1984 model. That meant it would enjoy an unusually long first-year production run. Even after 51,547 were manufactured, though, not everybody who wanted a 1984 could get one. In terms of its structure, suspension design, liberal use of lightweight materials, and all-around capabilities, buyers recognized that the C4 turned Corvette from an outdated car into a state-of-the-art performer. In so doing, it signaled that Corvette's decline was over, and the brightest days for America's iconic sports car lay ahead.

◀ Engineers and technicians analyzing the mating of a C4 body and chassis structure with its powertrain and suspension assembly in preparation for the new car going into production.


CORVETTE
NEW YORK
FER-7611
EMPIRE STATE

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TURNING THE CORNER

1985–1996

Though the 1984 Corvette was an incredible leap forward, it was not without its faults. Addressing those, and taking advantage of rapidly progressing technology, led to a steady stream of improvements during the fourth generation's thirteen-year model run. Combined, these advances enabled Corvette to catch up to, then decisively pass, the performance losses due to emissions, fuel economy, safety, and noise regulations—and still meet evolving consumer expectations. And the car's designers accomplished this without compromising the high levels of comfort, utility, and value that differentiate Corvette from every other high-performance sports car in the world.

◀ In 1986 Chevrolet built fifty Malcolm Konner Commemorative Edition Corvettes to honor the founder of New Jersey dealership Malcolm Konner Chevrolet. Each featured unique beige-over-black paint with graphite leather interior and special badging.

▲ A convertible was made available, for the first time since 1975, during the 1986 model year and a yellow drop-top paced the Indianapolis 500, leading Chevrolet to designate all 1986 convertibles as pace car replicas.

The first notable advance came in 1985, with the substitution of port fuel injection for Chevrolet's ill-fated Cross-Fire throttle body system. Chevrolet's engine team, led by Roy Midgley, integrated the Bosch injectors and hot-wire air meter with an AC Delco ignition system and sensors to create what Chevy called Tuned Port Injection. When equipped with this new setup, Corvette's 350-cubic-inch (5,735.47cc) V-8 met all emissions requirements, got 11 percent better fuel economy, and made considerably more power. The 1985 L98 engine was rated at 230 horsepower and 330 lb-ft (491.094 kilograms per meter) of torque, compared with the 1984 engine's 205 horsepower and 290 lb-ft (431.568 kilograms per meter).

Engine output increased another 5 horsepower for those 1986 Corvettes equipped with aluminum cylinder heads. These were standard on all cars in 1987, and the addition of roller rockers brought horsepower up to 240 that year. In 1988, for coupes only, horsepower increased to 245, owing to less restrictive mufflers deemed too loud for convertibles. Output went up another 5 horsepower in 1990 courtesy of a new air intake speed density control system, increased compression, and an improved camshaft profile.

Small, incremental power increases suddenly became large in 1992, with the introduction of an extensively reengineered small-block V-8, developed at GM Powertrain by a team under the leadership of Anil Kulkarni. The development team for this new engine set as their lofty goal power output that exceeded the optional high-revving LT1 offered in 1970–1972. And, of course, they had to get that tremendous power while still meeting stringent standards for specific mass, size, emissions, fuel consumption, and torque bandwidth. After the heavily revised engine met or surpassed all parameters, GM Powertrain honored it by reviving the LT1 moniker.

The new LT1's dramatically improved rating of 300 horsepower was derived from advances in computer-controlled ignition timing, higher-flow exhaust, a more aggressive camshaft profile, improved multiport fuel injection, better-flowing heads, and reverse-flow cooling. By pumping coolant to the heads first, rather than to the block, this new configuration allowed for higher cylinder temperatures and reduced ring friction.

The next increase in engine output came in 1996, with the introduction of the LT4 engine. Standard with the $3,250 Grand Sport option package, and available for $1,450 in other 1996 Corvettes, the LT4 featured higher compression, raised to 10.8:1 from the LT1's 10.4:1, improved cylinder heads and roller rockers, a new camshaft profile, and various other changes to earn its 330-horsepower rating.

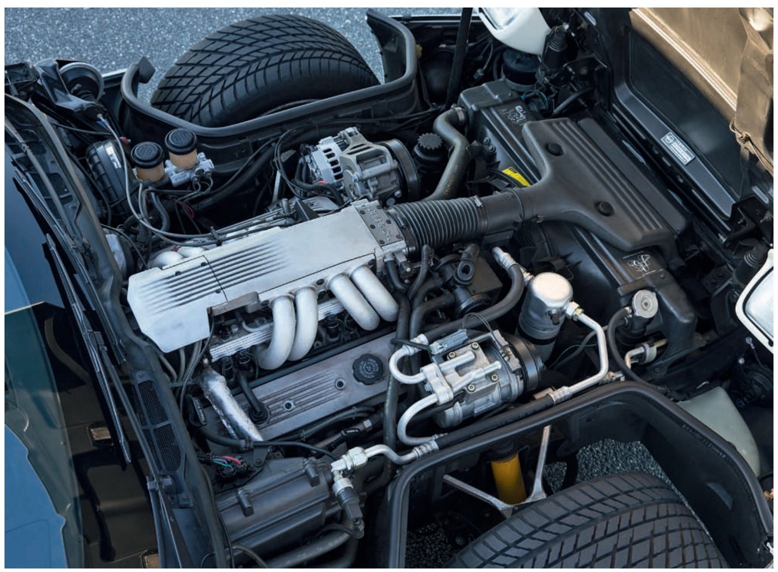
The BorgWarner/Doug Nash 4+3 transmission introduced in 1984 had no trouble handling the small added torque that came with engine advances through 1988, but it could not stand up to the LT5 ZR1 engine initially slated for 1989. This led to the adoption of a new manual gearbox that year. It was a six-speed designed jointly with Zahnradfabrik Friedrichshafen (ZF) based in Baden-Württemberg, Germany. The new transmission used Computer Aided Gear Selection (CAGS), a system that allowed the driver to move through all gears sequentially when accelerating hard but skipped second and third, going from first directly to fourth, when the driver upshifted with light throttle and at low speed. This feature of the ZF six-speed allowed it to deliver superb performance when called upon and at the same time provide excellent fuel economy where possible.

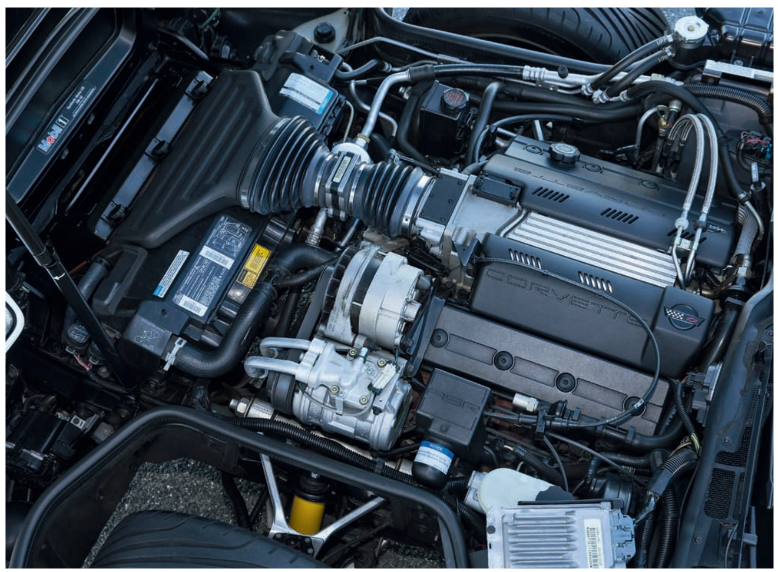
While engine output was steadily rising and drivetrain improvements were being implemented, the Corvette engineering group, led by Dave McLellan, devoted a great deal of its attention to improving the car's chassis. The 1984's base and optional Z51 suspension both proved too stiff in real-world driving conditions, particularly in those areas that saw harsh winters and resulting bad road surfaces. After extensive suspension development testing, led by John Heinricy, spring rates were reduced by 25 percent all around for the 1985 standard suspension, and by 16 percent in the front and 25 percent in the rear for the optional Z51 suspension. This yielded a much more comfortable ride with no appreciable degradation of handling.

Besides significantly improving engine performance, Chevrolet's adoption of Bosch fuel injection components for the 1985 Corvette eventually also led to a big improvement in braking performance. During negotiations for the injection hardware, Bosch let Chevy management know about its new, second-generation anti-lock braking system, which was still under development and showing great promise. The Bosch ABS-2 system was initially expensive, but Chevrolet engineering director Paul King saw great value in adding it to the 1986 Corvette, so he set in motion the work needed to achieve this.

Bosch fitted its system to Corvettes and did virtually all the initial development in Germany and Sweden. Chevrolet undertook a second stage of testing in Sweden and Michigan. Chevy development engineer Jim Ingle, who had done most of the testing of a four-wheel anti-lock brake system created by Kelsey-Hayes (K-H) in 1975, was given the lead in evaluating the Bosch system. The K-H system Ingle had tested a decade prior was based on pioneering work done by Delco Moraine in the mid-1960s to design rear-wheel anti-lock brakes for the front-wheel-drive Oldsmobile Toronado. Although a computer controlled its functionality, the system was rudimentary and fairly unreliable. Ingle was therefore highly skeptical going into testing, but after running the development cars through a wringer on Milford Proving Ground's Vehicle Dynamics Test Area, he came out a true believer. The other engineers testing ABS-2, including McLellan and Rick Darling, all agreed that the system was excellent, and after a considerable amount of tweaking it was introduced in 1986.

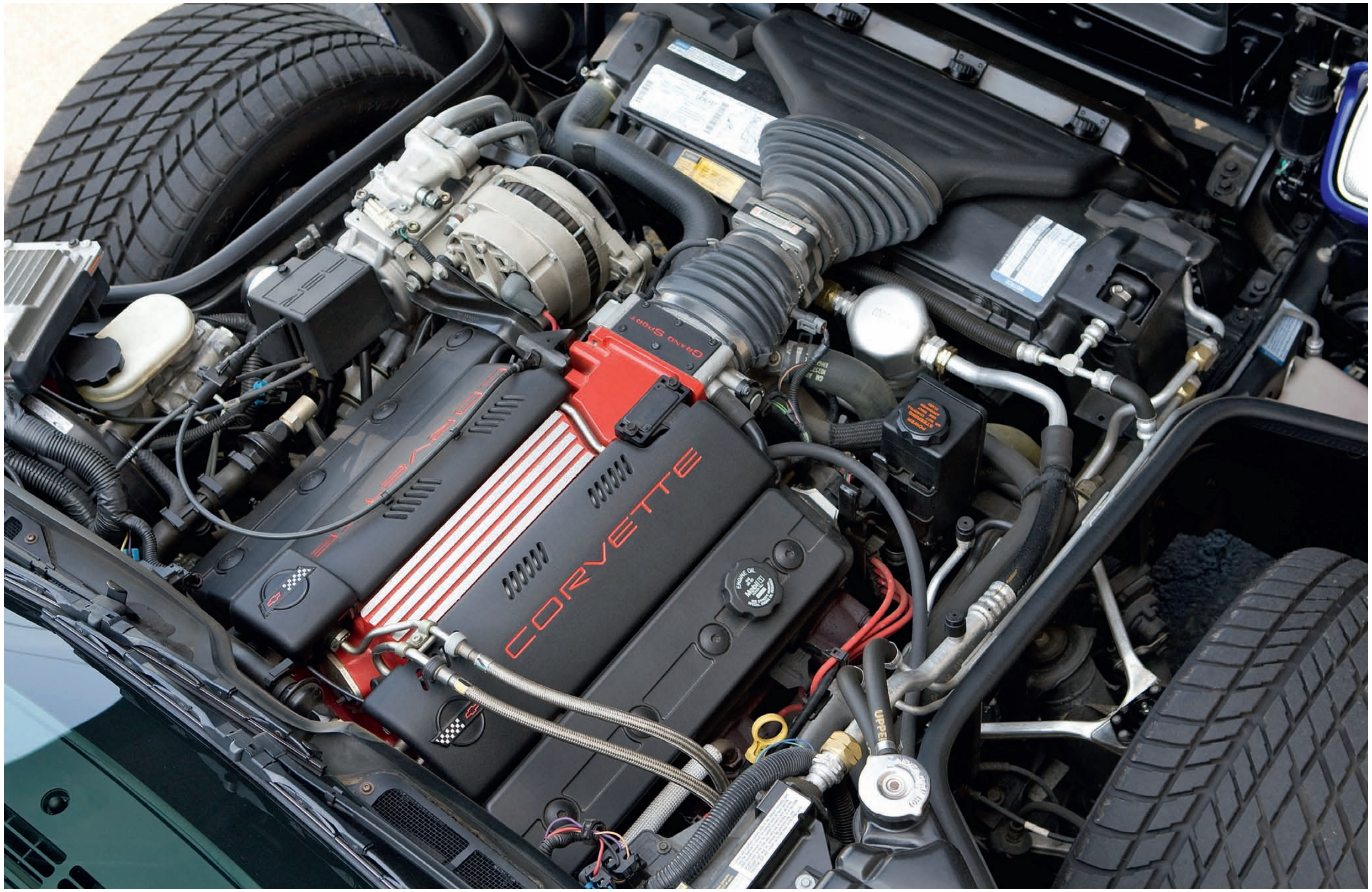
After adopting anti-lock brakes, the next logical step was adding traction control for the rear drive wheels. With the Bosch traction control system, introduced in 1992, sensors measured wheel speed relative to the car's road speed to determine when a wheel was starting to slip; when it was, the central processor simultaneously reduced throttle and





◀◀ The Tuned Port Injection system introduced in 1985 yielded 11 percent better fuel economy and 25 more horsepower than the Cross-Fire Injection used in 1984.

◀ In 1992 Corvette got the new LT1, an extensively reengineered 350 that delivered 300 horsepower by virtue of better computer-controlled ignition timing, higher-flow exhaust, a more aggressive camshaft, improved fuel injection, and more efficient heads.



▶ The 330-horsepower LT4 engine, featuring 10.8:1 compression, roller rockers, a more aggressive camshaft, and aluminum cylinder heads, was optional solely in 1996, and only with a manual transmission.

applied braking action to the offending wheel. All of this, from the measurement to the wheel slip to the application of corrective measures, occurred in a fraction of a second.

The tremendous advances in Corvette performance that came with ABS and traction control would not have been possible without concurrent advances in tire technology. As with all aspects of automotive engineering, it was the creation of incredibly powerful computers and highly sophisticated computer modeling that propelled tire performance forward during the C4 era. Computer tools that analyze material properties, construction methods, and every other aspect of tire creation and performance led to Goodyear, which was Corvette's exclusive tire supplier since 1978, engineering tires that delivered incredible handling, improved fuel economy, reasonable noise levels, excellent reliability, ultra-high speed capability, and long tread life.

C4 began life with a brand-new chassis design. Though imperfect, it was far superior to what had come before. Prior to the introduction of C5 in 1997, the only significant chassis changes came in 1986 with the re-introduction of a convertible body

◀ A 1988 35th-anniversary package included white paint, white leather interior, white wheels, and a unique logo used for body badges and seat embroidery.

style, which had been discontinued after 1975. To build convertibles, the rear roof post and upper bow structure had to be completely removed, a change that significantly diminished torsional stiffness. Chevy engineers countered this with several changes, including reinforcements for the front rails, a substantially larger double-wall riser behind the seats, larger braces under the engine mount brackets, X-members that tied the door hinge pillars to the rear chassis torque boxes, a crossmember added to the rear torque box, and strengthening of the cowl. Together, these changes made the convertible structure stiffer than the coupe's structure.

When introduced, the C4 was a state-of-the-art sports car that largely recaptured the performance lost to government regulations in the 1970s. As it evolved over its thirteen model year lifespan, advancing technology enabled Chevrolet's engineers and their supplier partners to surpass the performance of all prior Corvettes in every measure. And as we now know with the benefit of hindsight, this was only a small indication of the incredible performance yet to come.


CHEVROLET
Mobil
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TOM BELL
CORVETTE
CHALLENGE
MID AMERICA
BILSTEIN
Autosport
CHEVROLET
Mobil
98
Autosport

17

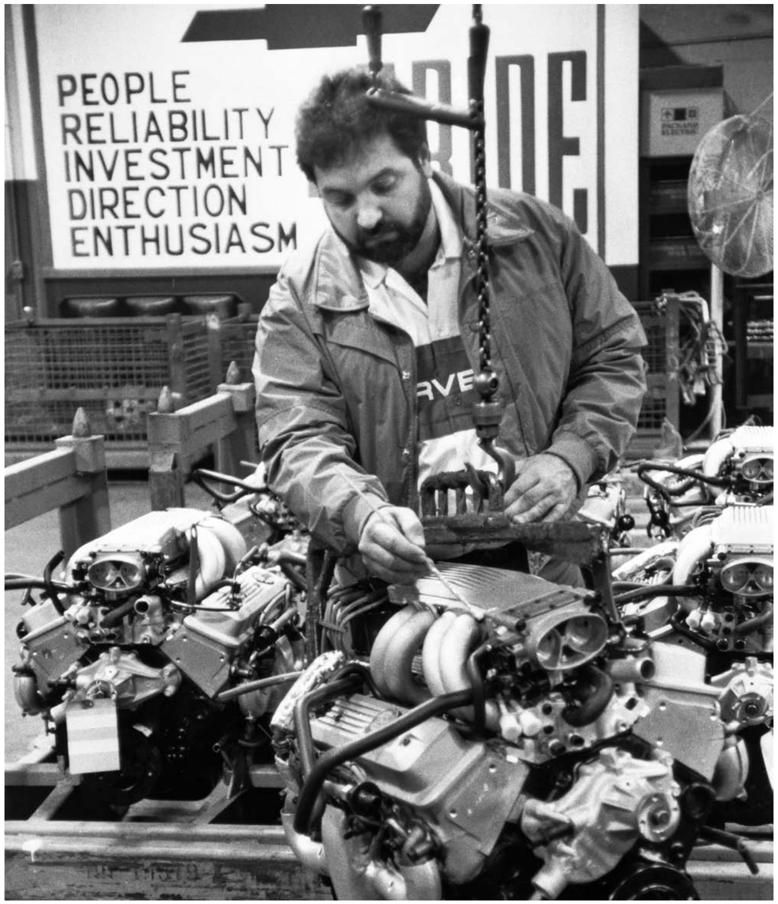
CHEVROLET GOES RACING

WITH THE C4

At the dawn of the 1980s, Corvette's best racing days seemed to be in the past. Loyalists were still racing the cars in IMSA, helped along by liberalized rules that allowed radical tube-framed, wide-bodied racers, but by 1980 even the best of them were worn-out relics. It would take a completely new, fourth-generation Corvette and Chevy's focus on showroom stock to get America's sports car back into the winner's circle in production-based racing.

◀ The No. 97 Corvette of David Carradine is one of twenty-two 1988 Challenge cars that competed in all ten races of the 1988 season, with a best finish of second place at the season opener in Dallas.

By the time the engineering and design teams were putting the finishing touches on the C4 Corvette in 1981, they knew it had the makings of a successful production racer. Shortly after the new car was introduced as a 1984 model, the SCCA announced it was going to expand its Showroom Stock Endurance Series for 1985 with a “Super Sports Division” that would include the Corvette, Porsche 944, and Nissan 300 ZX turbo. Corvette Chief Engineer Dave McLellan learned that several people were planning to run Corvettes in the new class, including Tommy Morrison, Dick Guldstrand, and Kim Baker, the latter having won the 1984 SCCA SSGT national title with his 1984 Corvette. McLellan met with Chevrolet Chief Engineer Don Runkle, Ralph Kramer, head of Chevy public relations, and Director of GM Racing Herb Fishel. They forged a plan to support teams running Corvettes in the Playboy-sponsored Showroom Stock Endurance Series.



▶ After technicians at GM’s Flint Engine Plant hand-assembled and dyno-tested each 1988 Corvette Challenge series engine to ensure that power output didn’t deviate from 245 brake horsepower by more than +/- 2.5 percent, Tommy Sapp, Protofab Engineering product manager, put security seals on key fasteners to deter tampering and ensure that each driver in the series had equal power.

Corvette Development Manager Doug Robinson oversaw racer support from the entire Corvette product group, including powertrain, chassis, body, and electrical. He initially worked with the team of Tommy Morrison, Jim Cook, and Dick Guldstrand to test and develop the new Corvette for endurance racing. The development program yielded numerous improvements for the cars, including more durable brake pads from Girlock, optimum camber and toe settings, stronger wheel bearings, and a motorsports compound-“S” version of standard Goodyear Gatorbacks. The development group also learned just how much better synthetic lubricants were in a racing environment and ended up using them for not only the engine, but also the transmission, axle, and power steering.

At the 24-hour race at Riverside that opened the 1985 season, the three-car Morrison-Cook team was ready for battle. The engineers had developed a highly efficient fueling rig and the crew practiced fueling as well as tire and brake pad changes until they could perform these tasks blindfolded. When the checkered flag flew, the Morrison-Cook team finished first and second overall. This astounding performance for the new cars in their first race was not a fluke: Corvettes ended the 1985 season with a perfect record, winning every 3-, 6-, 12-, and 24-hour race in the series.

For the 1986 season, SCCA acquired Escort as a new title sponsor to replace outgoing Playboy. Despite the drubbing they’d suffered a year before, Porsche came into the 1986 season with renewed confidence, owing largely to the introduction of its new turbocharged 944S. Well aware of the increased threat from Porsche, Chevrolet continued development in the off-season, an effort that paid big dividends throughout the year. The Porsches were fast, earning several poles and leading some of the races, but they could not overcome the Corvette’s superior fuel economy, excellent reliability, and numerical advantage. Rippie Anderson Motorsports won the six-hour opener at Sears Point, Morrison-Cook won the twenty-four-hour event at Nelson Ledges, and Bakeracing won the remaining four races to earn the championship and give Corvette another perfect season.

There was a symbiotic relationship between the production and race cars thanks to Chevrolet's close support of showroom stock racing. Several racing-inspired improvements planned for the 1988 model year, including larger brakes and improved rear suspension, were introduced early so they'd be legal to race in 1987.

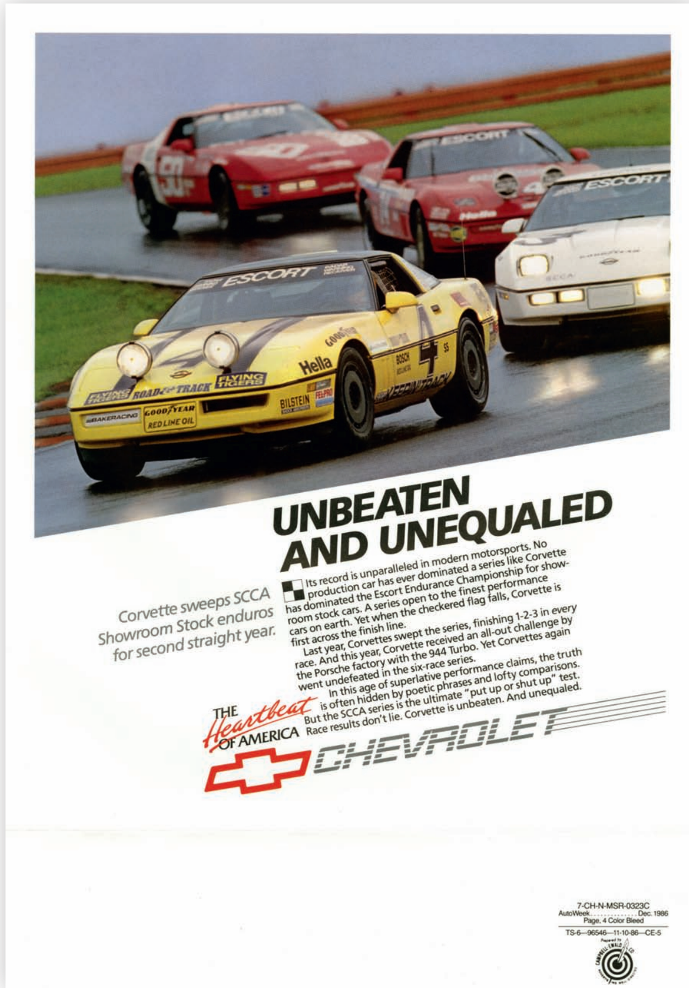
Porsche sold nine new 944 Turbo Cup cars in 1987, and at least three were fielded with strong factory support in each of the Escort Endurance Series races. They were quite fast, outqualifying the Corvettes at most races and leading much of the time. As in the previous year, however, they could not overcome the Corvette's reliability, fuel economy, and overwhelming numbers. Corvette shut out the competition again, winning all twelve of the season's endurance races. Bakeracing won the team championship, Tommy Archer clinched the driver's title, and Chevrolet earned manufacturer's honors.

Corvette's total domination was not good for the series, leading SCCA to prohibit them from competition after the 1987 season. In response, one of the Corvette racers, Canadian John Powell, organized a Corvette-only series for 1988. The Corvette Challenge, as it was called, consisted of 1-hour sprint races held in conjunction with Trans-Am events. Chevrolet built fifty-six 1988 Corvettes specifically for the Challenge series. They were street legal and stock except for sealed engines that were equalized for power output. Fifty of the cars went to Protofab Engineering in Wixom, Michigan, for installation of a full roll cage, fire suppression system, five-point safety harness, racing seats, and Dimag magnesium wheels.

The Corvette Challenge, which ran for two seasons, provided exciting wheel-to-wheel racing and attracted a number of big-name drivers, including Johnny Rutherford, Juan Fangio II, Jeff Andretti, and Jimmy Vasser. Stu Hayner won the championship in 1988 and Bill Cooper finished first in 1989.

While Chevrolet was primarily focused on showroom stock racing in the 1980s, it was not to the exclusion of all else. GM racing boss Herb Fishel never let go of his desire to see the company's products competing for overall wins in the world's

◀ The No. 2 Corvette Challenge car of Juan Manuel Fangio II qualified on pole and finished third at the wet Mid-Ohio round in 1988.



▼ Chevrolet leveraged the Corvette's absolute domination of SCCA showroom stock endurance racing by pointing out that "Race results don't lie. Corvette is unbeaten. And unequaled."

▲ This ad explains what and why Chevrolet was racing in the IMSA GTP class and recognized the Corvette GTP's first win at Road Atlanta on April 6, 1986.

▶ Corvette GTP racers were campaigned by Hendrick Motorsport, Lee Racing, and others in IMSA's Camel GT series from 1985 to 1988.

most prestigious sports car events and drew inspiration from the success of the small-block Chevy-powered Lola T-600 coupe in IMSA GTP competition following Brian Redman's 1981 championship season.

Chevrolet partnered with Lola Cars International Ltd. to design and construct a Corvette GTP chassis based on the T-600. With help from Chevy stylists Jerry Palmer and Randy Wittine, the new car, which Lola called a T-710, had obvious Corvette styling cues.

Ryan Falconer began building Chevrolet racing engines for Lola after the four-cam Ford he built for George Bignotti and John Mecom won the 1966 Indy 500. Now he had been tapped to develop and build the GTP's turbo engine based on Chevrolet's production 90-degree V-6. Equipped with Chevy's cast-aluminum heads and a compact, rear-mounted Warner-Ishi RX9-L turbo, the over-square 209-cubic-inch (3,424.9cc) engine produced 750 horsepower at the start of the program and nearly 900 horsepower by the time it began racing.

Rick Hendrick Motorsports was contracted to run the GTP on behalf of Chevrolet. After testing at Goodwood, Laguna Seca, and elsewhere in 1984 and early 1985, they ran a few races at the end of 1985. In the season finale at Daytona, Sarel Van der Merwe shattered the qualifying record by nearly 2.0 seconds and ran away from the field in the Corvette GTP. A series of problems, beginning with the sudden loss of its rear cowling on lap 8, put Van der Merwe and co-driver Bill Adam some twenty-four laps behind the race-winning Al Holbert/Al Unser Jr. Porsche 962. Another Corvette GTP, entered by Lee Racing and driven by Lew Price, Chip Mead, and Carson Baird, managed tenth overall, five laps off the winner's pace.

Hendrick Motorsports and Lee Racing both contested the full season in 1986, with Hendrick serving as the factory entry. As in 1985, the Corvette GTP was almost always fastest in the field but at the same time almost always too fragile to maintain its lead. The team's first win came on April 6, 1986, at Road Atlanta. Van der Merwe set a new qualifying mark of 1 minute 12.001 seconds (one of Van der Merwe's seven consecutive poles in 1986) and with co-driver Doc Bundy convincingly broke Porsche's sixteen-race winning streak at a record-setting pace. Van der Merwe and Bundy would win one more race in 1986, at West Palm Beach in June.

The factory-backed Hendrick Motorsports and privateer Corvette GTPs raced two more seasons, with the turbo V-6 in 1987 and naturally aspirated V-8s following an IMSA rules change in 1988, but their story remained essentially unchanged. They were ferociously fast but painfully fragile, earning many poles and setting a string of qualifying and race lap records—but more often than not failing to finish.

While the GTP cars did not leave behind a winning record, their blinding speed thrilled spectators and did a great deal to advance GM's racing know-how in the 1980s. In contrast, Corvette's showroom stock racing was an unqualified success in every measure. It helped Chevrolet sell cars, accelerated Corvette's technology advance, and greatly nurtured the mindset within GM that subsequently embraced a full-factory Corvette GT program to take on and ultimately conquer the world's best production sports cars.

◀ Chevrolet contracted with Bob Riley's Protofab shop to design and build a tube-frame C4 Corvette chassis to go underneath John Cafaro–designed bodywork, for competition in both IMSA's GTO class and SCCA's Trans-Am series.

▼GM stylists Jerry Palmer and Randy Wittine designed a body with C4 cues for a Lola T-710 chassis to create the Corvette GTP.

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BOLD MOVES

1987–1991 CALLAWAY AND 1990–1995 ZR-1

For the first twenty years of Corvette's existence, Chevrolet's powertrain engineers could focus nearly all of their attention on finding ways to make ever more power from reliable and cost-effective engines. That changed dramatically with the Clean Air Act of 1970, the Highway Safety Act of 1970, and the Energy Policy Conservation Act of 1975. These laws and the regulations they spawned dramatically increased the federal government's role in regulating vehicle emissions, fuel economy, and safety standards.

◀ NACA ducts in the hood, used only in 1987 B2K Callaway twin-turbo Corvettes, brought fresh air to the engine's intercoolers.

As a direct result, in 1975 Chevrolet eliminated the big-block engine from its entire passenger car lineup, including Corvette. Given the technology of the day, big-blocks could not meet the coming emissions and fuel economy requirements. Shortly thereafter Chevrolet adopted common engine configurations for all its cars, meaning Corvettes no longer benefited from exclusive, high-output engine options. The company was forced to do this because of the high cost and complexity of certifying engines to comply with federal emissions standards.

Ever mindful of the decisive role that engine power plays in Corvette's appeal—and thus its sales—Chevrolet pursued several technologies to meet power-killing, government-imposed emissions and economy requirements, while at the same time serving customer expectations for more power. Those technologies included electronic fuel injection, turbocharging, electronic engine management systems, multi-valve cylinder heads, and multiple camshafts. Some of these, including electronic fuel injection and electronic management systems, found their way into regular production C4s. At the same time, two far more complicated approaches spawned a pair of incredibly powerful special models: one that featured turbochargers and one that used a nearly all-new engine with multiple valve heads and overhead camshafts,

CALLAWAY B2K TWIN-TURBO

Chevrolet had experimented with turbocharging since the 1950s and seriously considered it for C4, but ultimately shelved the idea. When the company decided that it would not produce a turbocharged C4 Corvette, however, management made an unusual decision regarding the program's future. Instead of simply putting aside all the research and development that had been done, GM struck a deal with Callaway Cars. The arrangement, orchestrated by Chevrolet market planning chief Don Runkle, entailed Chevy providing technological, logistical, and financial support so that the Old Lyme, Connecticut, specialty builder could keep moving the technology forward until it could be put it into production.

Callaway was not the first outside company to help GM with developing a turbocharged Corvette. In May 1983 Chevrolet contracted Troy, Michigan–based Specialized Vehicles Incorporated (SVI) to execute sixteen prototype Corvette turbo engine installations. Packaging concerns meant that the plans initially called for SVI to produce a twin-turbo V-6. Corvette Chief Engineer Dave McLellan and others with influence at Chevrolet, including the marketing department, were not particularly enthusiastic about installing a V-6 into Corvette regardless of how much horsepower could be squeezed out of it. After Chevy learned that a twin-turbo V-8 could fit in Corvette's engine compartment, SVI was asked to abandon the V-6 and concentrate instead on a V-8. They delivered a functional and reasonably well-designed twin-turbo V-8 Corvette to Chevrolet early in 1985. By August 1985, SVI had fulfilled its contract with GM and delivered the last of sixteen twin-turbo Corvettes for further testing.

The twin-turbo Corvettes built by SVI were primarily intended to evaluate the feasibility of packaging a twin-turbo V-8 in the existing Corvette and test its effects on the chassis. By contrast, Callaway's expressly stated mandate was to develop a complete twin-turbo package that would pass all of GM's validation tests and that did not affect its existing emissions systems in any significant way.

In June 1985, Callaway received the collected information gained from Chevrolet's collaboration with SVI, along with one of the twin-turbo Corvettes. Callaway was chosen to make the turbo package production-ready because the company had already demonstrated its ability to successfully design, fabricate, and sell turbocharging systems and, equally important, to also get through the onerous certification process that would allow them to bring low-volume production of turbocharged cars to market. The latter had been effectively demonstrated when Callaway began producing turbocharged 2.5-liter GTV-6 coupes for Alfa Romeo in 1983.

Even after all the work SVI and Chevrolet had already performed, Callaway had to overcome several difficult problems, including developing a viable fuel-injection system, packaging all the extra hardware in Corvette's already cramped engine compartment, and simultaneously meeting power targets and emissions requirements. Callaway quickly abandoned Chevrolet's plans for a scaled fuel-injection system designed to provide the extra fuel demanded by the turbochargers while meeting the EPA's stringent emission standards, and instead solved the riddle by leaving the regular production fuel-injection system untouched and adding a pair of additional Bosch fuel injectors ahead of the throttle. These two auxiliary injectors operated independently from the stock engine management computer. They were instead directed by their own control system, using Callaway's proprietary Microfueler II computer module. The Microfueler II delivered the necessary extra fuel when the turbo boost kicked in but didn't interfere with the stock fuel-injection system's functions when the car was driven without boost.

As far as packaging was concerned, Callaway took advantage of every bit of what little room there was under Corvette's hood. In 1987, the first year of production, engine air was brought in through two large NACA ducts in the hood, but beginning in 1988, Callaway engineers used the stock frame rails as conduits to bring outside air into the engine. A compact IHI RHB52 turbo was mounted on either side of the engine toward the bottom and twin air-to-air intercoolers were prominently located on top of the engine. It was an altogether elegant solution to the packaging conundrum.

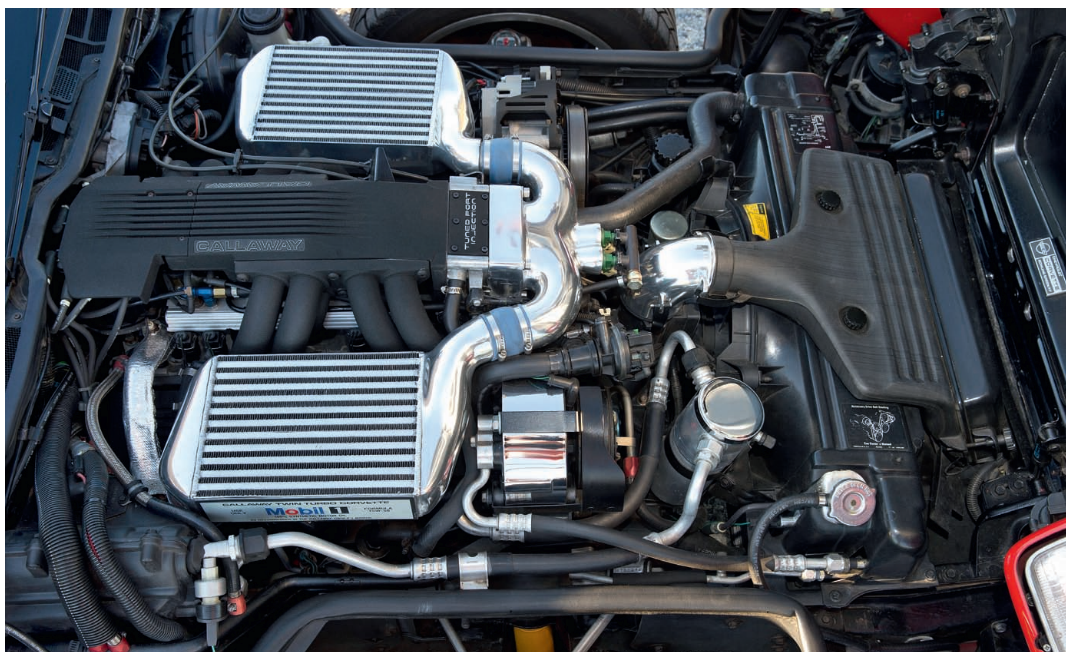
By not touching certain critical systems and components that would directly impact emissions—most notably the fuel injection setup and camshaft—the twin-turbo engine package could get through the EPA certification process much more easily under rules that didn't require small specialty shops to completely recertify an engine that was already certified.

Callaway's twin-turbo engine produced 345 horsepower and 465 lb-ft (691.99 kilograms per meter) of torque. The turbos delivered initial boost at 1,100 rpm and full boost of 10 psi by 2,000 rpm and created an incredibly broad torque curve that was at least 50 percent above the stock L98's torque output across the entire rpm spectrum. This wide power band gave the car performance that went beyond its raw power numbers.

The engine's enhanced power output required corresponding hardware upgrades. The first four customer engines Callaway assembled were built with heavy-duty, four-bolt main bearing Chevrolet LF5 truck blocks, while subsequent engines were built up using extensively reworked Corvette blocks. Low-compression forged aluminum Cosworth or Mahle pistons spun a forged, gas-nitrided steel crankshaft, with a high-output Melling oil pump ensuring adequate lubrication. A dry-sump oiling setup delivered a constant supply of pressurized oil to the turbo bearings. Stock aluminum cylinder head castings were remachined and fitted with stainless-steel

◀ Dave McLellan became Corvette Chief Engineer in 1975, when performance was at its lowest. Barely a decade later he oversaw the process that brought Corvette to new performance highs with the LT5 and ZR-1 it would power.

▼ Callaway used every inch of underhood space to add a pair of IHI RHB52 turbochargers, twin air-to-air intercoolers, and related hardware to C4 Corvettes.



▲ The exterior appearance of this 1989 B2K Callaway is distinguished from standard Corvettes by its 17x9.5-inch (43.18x24.13-centimeter) Dymag wheels wearing Goodyear P275/40ZR17 tires, and Callaway badging.

▶ The Callaway twin-turbo package included special interior badges and boost pressure gauge located in what was otherwise an HVAC vent.

intake and exhaust valves and stronger valve springs. All machine work was extremely precise, and each engine's entire reciprocating assembly was balanced to ensure smooth, reliable power through the engine's operating range.

In a remarkable departure from normal practice, the twin-turbo package was given a genuine Chevrolet option code and could be ordered through a select group of authorized Chevy dealers. All orders for the option, called B2K, went down the regular assembly line in Bowling Green and were completely assembled with a normally aspirated engine just like non-turbo cars. After completion the cars were shipped to Callaway Cars in Old Lyme, where the twin-turbo engine installation, as well as the other Callaway-specific modifications, were carried out. Though it was obviously redundant to install engines into cars that would soon have those engines replaced, the procedure allowed the Callaways to be built side-by-side with ordinary Corvettes without any interruptions to the normal assembly process. The B2K twin-turbo option was available from 1987 to 1991 and it came with a full factory warranty.

The B2K Corvette was unveiled to the media in June 1986 at the Milford Proving Ground during Chevrolet's 1987 model year press preview. Media members were predictably delighted with the car's performance. It would sprint from 0 to 60 miles per hour in 4.6 seconds, click off the standing quarter mile in 13.02 seconds at 108 miles per hour (173.8 kilometers per hour), and reach a top speed of 178 miles per hour (286.46 kilometers per hour). All that performance came at a high price, though: in 1987 the option added $19,995 to the cost of the car, which was $27,999 for a coupe and $33,172 for a convertible. In addition to the complete turbo engine conversion, buyers got a variety of other enhancements, including a different transmission and cooling system, each of which was upgraded to handle the turbocharged engine's power and heat output.

In 1987 Callaway built 121 coupes and 63 convertibles. A year later, in 1988, the twin-turbo engine's power increased to 382 horsepower and 562 lb-ft (836.35 kilograms per meter) of torque. The cost also rose to $25,895 in addition to the base cost of $29,849.00 for a coupe or $34,820.00 for a convertible. Unlike the previous year, buyers of a 1988 B2K-optioned car could get an automatic transmission. These were strengthened Turbo Hydra-Matic 400 truck units and added another $6,500.00 to the cost. A total of 124 twin-turbo Corvettes were made in 1988, and another 69 were produced in 1989, the option's final year.

ZR-1

In the early 1980s, everyone in a leadership position vis-à-vis Corvette, from Chief Engineer Dave McLellan and Chevrolet-Pontiac-Canada (CPC) General Manager Lloyd Reuss to Chevrolet Chief Engineer Don Runkle and CPC V-8 Chief Engineer Roy Midgley, understood the need to significantly increase power for future Corvettes in spite of ever-tightening fuel economy and emissions standards. At first, they did not know how to accomplish this, but by early 1985 it was clear that turbocharging the Chevy V-8 could meet every objective. That is, every objective except one: Lloyd Reuss always looked upon Corvette as more than another car in GM's range. For him, it was the right platform to bring cutting-edge new technologies and innovative performance solutions to market in order to demonstrate GM's capabilities. He concluded that turbocharging, which was increasingly used to boost power in economy cars with diminutive engines, was too commonplace and, in effect, too low-tech for the new high-tech Corvette. Instead, he believed a dual-overhead camshaft (DOHC) engine design was the correct way forward.

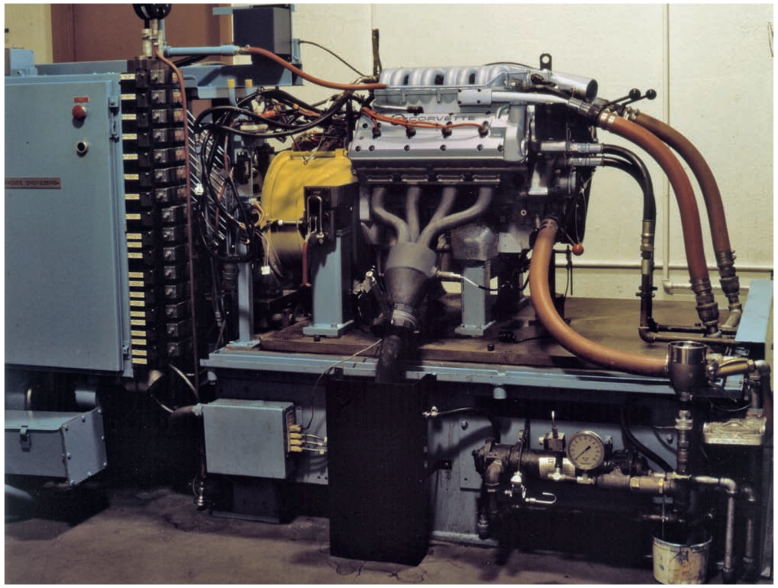
Reuss was no stranger to DOHC engines. Before advancing to the top steps of GM management, he served as a powertrain design engineer for almost twenty years, and in fact was director of the DOHC Cosworth Vega engine program for Chevrolet. Roy Midgley was assistant staff engineer for the Cosworth Vega engine, so he too had considerable experience with DOHC engines. At the same time the decision was made to move toward DOHC technology for Corvette, Midgley and others at GM were actively developing a new four-cylinder DOHC engine.

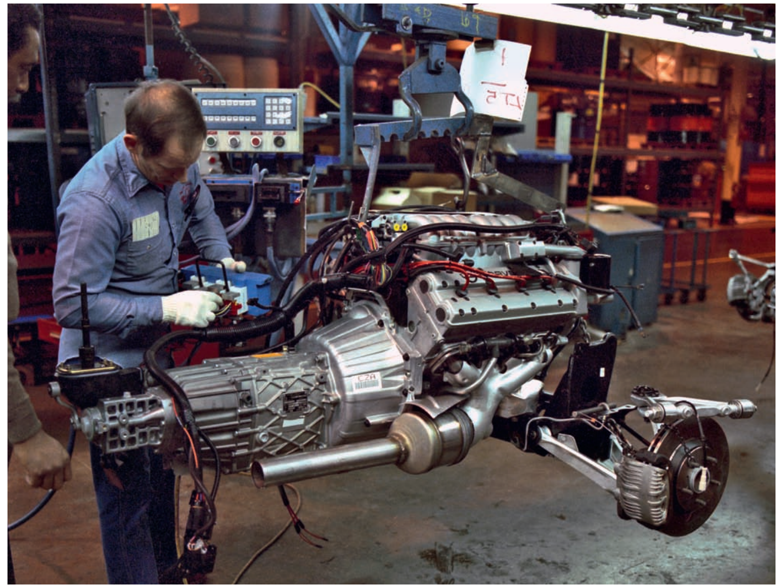
The initial plan was to design DOHC cylinder heads for the existing Chevrolet V-8 engine. This, everyone involved thought, could potentially yield a 300-plus-horsepower engine for Corvette that was emissions and fuel economy compliant and, importantly, available at an acceptable price point. In November 1984 GM Powertrain Engineering Director Russ Gee instructed Midgley to begin preliminary design work on a four-valve DOHC aluminum cylinder head for Chevy's V-8. Only a small number of DOHC heads would be produced, so GM would need to partner with an outside specialty company to help design and produce them. In late 1984 Russ Gee and Joe Bertsch, GM Powertrain's chief engineer of advanced engines, began to evaluate potential partners, including Cosworth, Ilmor, Lotus, Porsche, and others. Following a January 1985 visit to Lotus in Hethel, England, they decided it was the right company to carry the DOHC cylinder head project forward.

Under the leadership of brilliant aero and racing engineer Tony Rudd, managing director of Lotus Engineering, a team spearheaded by Dave Whitehead began collaborating with GM's engineers to create a new cylinder head that would meet all design requirements. As work progressed, however, it became apparent that what they set out to do was simply not feasible. One of the biggest obstacles was the size of the engine. Four-valve, DOHC heads would inevitably be larger than the standard two-valve heads they were to replace and there was insufficient room to accommodate them in Corvette's tight engine bay. A wider engine also precluded its installation on the Bowling Green assembly line because the engine had to pass through Corvette's chassis rails to install into the body from underneath.

▶ In May 1987 Lotus was dynamometer-testing the first operable LT5 engine, which demonstrated inadequate oil flow-back to the bottom end, necessitating extensive additional design work.

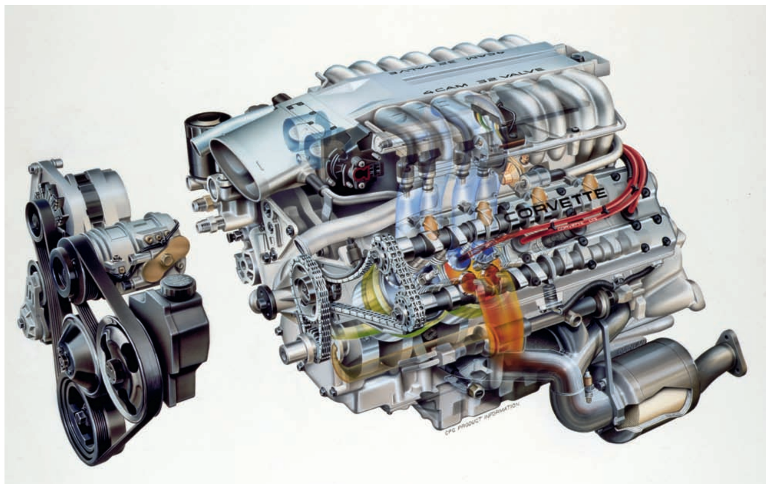
▶▶ A technician on the Bowling Green assembly line testing an LT5's electronics.





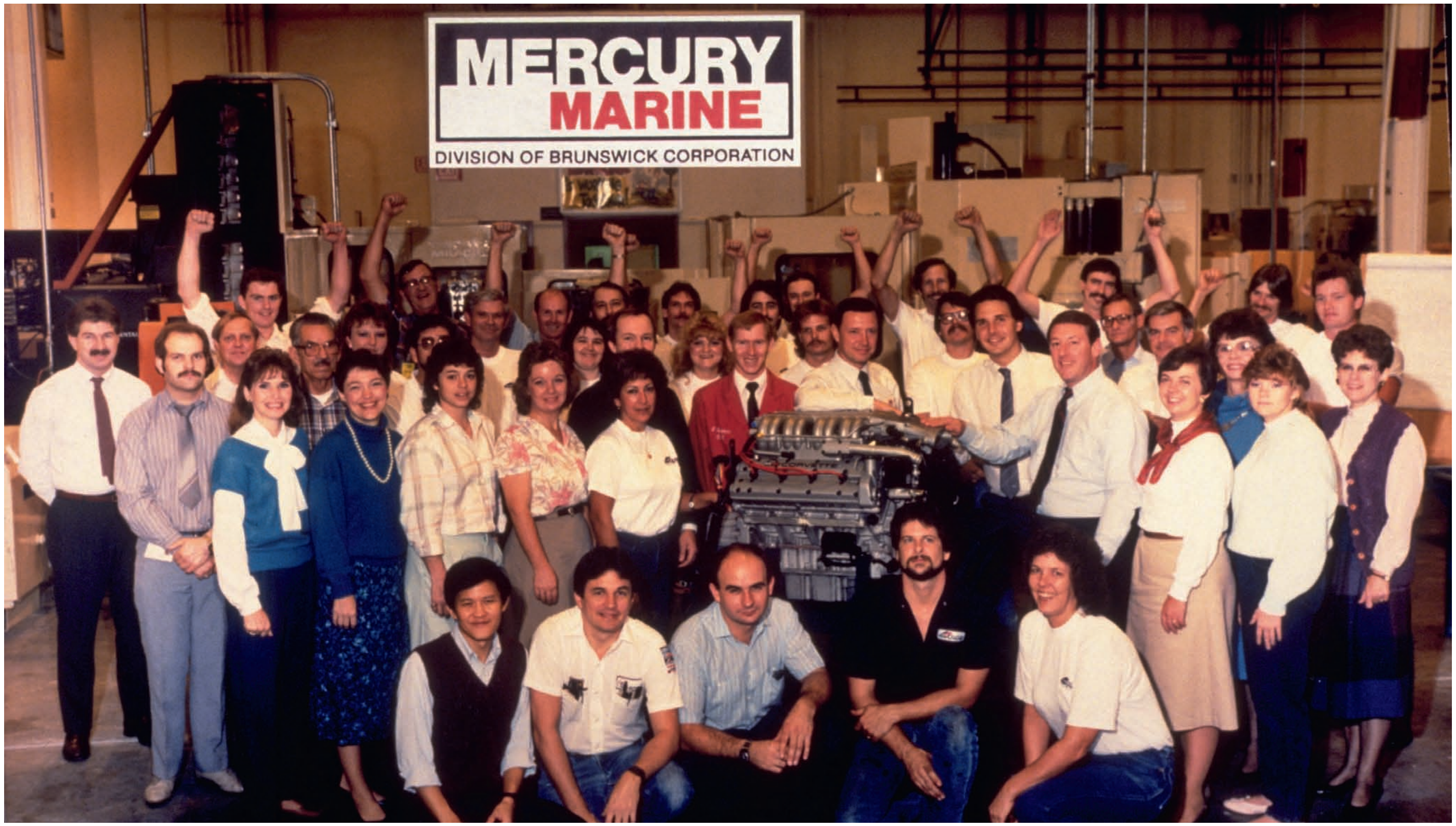
▶ This cutaway shows the complex inner workings of the LT5 engine, including its chain-driven dual overhead camshafts.

▶▶ MerCruiser employee Jose Gonzalez, *right,* explains the complex LT5 cylinder head machining processes to Chevrolet general manager Jim Perkins.



The only practical way around the packaging problem was to scrap the idea of putting new heads on Chevy's existing V-8 and design an entirely new engine. Besides solving the space problem, this would allow the engineers to optimize the entire engine, including cooling, oiling, and fuel delivery systems. It was hoped that this would also yield a lighter, more compact engine. The only obstacle, albeit a giant one, was the immense cost an entirely new engine would demand. It would run into the millions and was the primary reason why Chevrolet had not brought a new V-8 to market in more than twenty years.

The capital investment needed for a new engine had to be approved by the highest levels of GM management and it was a tough sell for Reuss, who spearheaded the effort. He had to argue that the benefits of new, cutting-edge technology for an engine would reach far beyond Corvette, even though the engine would be offered only in Corvette. With invaluable support from GM Powertrain leadership and GM Chairman and CEO Roger Smith, Reuss successfully argued that an advanced DOHC engine would stave off coming competition from Japan, preserve Corvette's position as the best all-around



◀ In March 1990, on Firestone's 7.712-mile (12.41-kilometer) oval test track in Fort Stockton, Texas, Tommy Morrison led a team that established six new FIA International Category A, Group II, Class 10 speed and distance records with an L98-powered Corvette, and the FIA unlimited class 24-hour speed and distance records and a 5,000-mile (8,046.72-kilometer) speed record with a ZR-1 Corvette.

▼ Chevrolet contracted with MerCruiser Division of Mercury Marine in Stillwater, Oklahoma, to manufacture the LT5 because of its highly sophisticated, large-aluminum casting capabilities and extensive computer-controlled machining experience.

high-performance car in the world, advance engine technology throughout GM, and likely even wind up turning a profit.

Once funding was approved, the hard work got underway in earnest. The new engine would be installed into Corvettes on the existing Bowling Green assembly line without any structural modifications to the cars, but otherwise the engineers were largely free to find the most elegant and efficient solution to each obstacle they encountered. Veteran Chevy engineer Gib Hufstader was put in charge of the immense challenges packaging the new engine in an existing chassis that was not designed for it presented, and his efforts were integral to its success.

Early in the process, Chevy Chief Engineer Runkle successfully advocated for making this new powerplant, dubbed LT5, more than just an engine option. He, McLellan, Reuss, and Gee agreed that it was advantageous to position it as an ultra-high-performance model distinct from the base Corvette. The new model would be called ZR-1, and its success paved the way for the ZO6, ZR1, and Grand Sport models that came in subsequent generations.

As the entire program came into sharper focus, work ramped up at CPC and Lotus, with key personnel added to the teams on both sides of the Atlantic. For a variety of reasons, not least of which was the always-present possibility that GM's financial people would change their minds and pull the plug, everyone responsible for the new engine was determined to complete the work in record time. In fact, their target was to complete the design and development in half the five or six years it normally took GM to create an all-new engine, which meant the ZR-1 Corvette could come to market as a 1989 model.

In the end, owing to myriad challenges the engineers and designers had to overcome, they missed the target by several months. Rather than build a small number of 1989 ZR-1s, Chevrolet chose to debut the car as a 1990 model. Released that year, the LT5 engine produced 375 horsepower and was remarkably efficient, so much so that ZR-1 Corvettes did not incur a gas-guzzler tax. It was, however, heavier than its creators had hoped, tipping the scales at 40 pounds (18.14 kilograms) more than the standard iron-block Corvette engine.

To the surprise of many, actual production of the engines was contracted to the MerCruiser Division of Mercury Marine in Stillwater, Oklahoma. Dick Donnelly, who was GM's manufacturing manager in the 1980s, determined that it was not feasible for such a specialized, small-volume engine to be made in one of the company's regular engine plants. After evaluating a wide number of potential manufacturers, including Lotus, Coventry Climax, and John Deere, CPC Chief Engineer Midgley and Paul Loukes from GM Manufacturing concluded that Mercury Marine was a perfect fit for a number of reasons, including its highly sophisticated capabilities for large aluminum casting and extensive experience in computer-controlled machining.

▶ Chevrolet designer Tom Peters was largely responsible for the LT5's aesthetics, which is why it's as beautiful as it is functional.

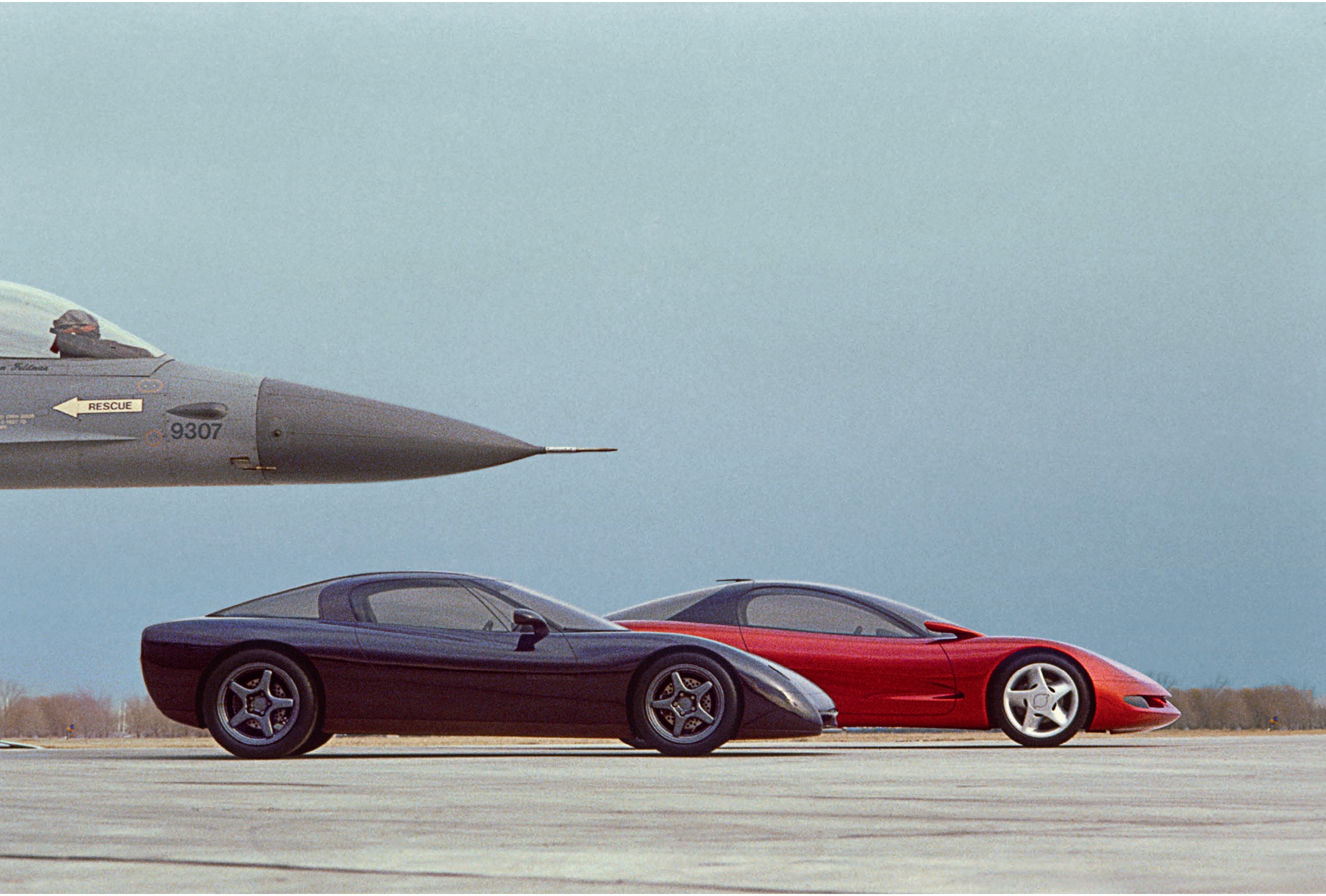
▶▶ ZR-1 Corvette interiors were distinguished by the key switch beneath the radio, which gave owners the option to set engine power to normal or full, with the normal setting limiting engine output to about 210 horsepower by not allowing the secondary port throttle valves to open or the secondary injectors to function.

◀ The ZR-1 got a wider body that the standard Corvette, with different doors, quarters, rockers, rear fascia, and rear deck.

▼ It was essential that the LT5 be narrow enough to fit between the Corvette's chassis rails so it could be installed into the body from underneath on the Bowling Green assembly line, just as the standard engine was.

In addition to their potent all-aluminum DOHC LT5 engine, ZR-1s were distinguished from ordinary Corvettes by their bodywork, which was 3 inches (7.62 centimeters) wider in the rear and capped by a more rounded rear fascia. The additional width enabled the body to fully house 11-inch (27.94-centimeter) wide wheels wearing massive 315/35ZR17 Goodyear Eagle unidirectional Gatorbacks.

Though 1990 ZR-1s offered tremendous performance, including mid-4.0-second 0–60-mile-per hour (0–100-kilometer-per-hour) times, 12.8-second quarter miles (0.402 kilometers), and a top speed of 175 miles per hour (281.63 kilometers per hour), the cars came with a steep price tag: they cost $27,016.00 above the coupe's base price of $31,979.00, making them the most expensive Corvettes produced to that date. The LT5's power and the car's cost rose in tandem in subsequent years, with output peaking at 405 horsepower from 1993 to 1995, and the additional price peaking at $31,683.00 from 1991 to 1993 before dropping to $31,258.00 in 1994 and 1995. In 1990 a total of 3,049 ZR-1 Corvettes were manufactured, but production diminished in later years, with 2,044 made in 1991, 502 made in 1992, and 448 made in each of the final three years.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19

WORLD CLASS

C5 INTRODUCTION, 1997

When brought to market as a 1984 model, the C4 immediately transformed Corvette from a lackluster performer with an old design and equally outdated technology to a modern, high-performance machine. Within just a few short years after its introduction, by virtue of the intelligent application of advancing technology and lessons learned in showroom stock racing, Corvette Chief Engineer Dave McLellan and his colleagues, the individuals competing in C4s, and a few enthusiasts within GM's management ranks brought Chevrolet's sports car to new levels of performance that could not be dreamed of just a decade earlier.

◀ The C5 design proposals created by John Cafaro and Tom Peters were built as full-size fiberglass appearance models and viewed at Selfridge Air National Guard Base.

▲ The C5's structure, which used a central-sheet steel tunnel, hydroformed side rails, front and rear boxed cross members, and cast-aluminum front and rear cradles, was four times as still in torsion as the C4's structure.

How they could possibly top this was the question on everyone's mind in 1989 when preliminary work got underway for the next-generation Corvette. For McLellan, the answer was obvious: they would have to engineer a completely new car, incorporating everything they knew, to deliver a safer, more spacious, more efficient, more comfortable Corvette with performance equal to or better than the showroom stock racers and ZR-1s—but at a price comparable to the base C4.

SUPERIOR STRUCTURE

Still stinging from the C4's structural issues that had arisen when it was changed from a T-top to a Targa top too late to fully compensate for the loss of stiffness, McLellan vowed to create a structure for C5 that left nothing on the table. And to ensure that it met all engineering objectives handily, he determined that it would be designed from the beginning as a convertible, something that had not been done for any prior Corvette.

The Corvette group asked Lotus Engineering, which GM had owned a controlling interest in since 1986, for an analysis of how significantly greater structural strength could be achieved and the company, based in Norfolk, England, responded unequivocally: the next Corvette needed to have a torsionally stiff backbone. The concept was certainly not new to the automobile industry, or even to GM, with a Chevrolet Research and Development proposal to build the Corvette convertible with a central backbone dating to 1964. To date, though, nobody had done it in a lightweight, front-engine, rear-wheel-drive, commercially viable passenger car with the choice of manual or automatic transmission.

The Corvette group and Chevrolet Research and Development looked at the feasibility of using a central backbone and quickly concluded the design was possible only if the transmission was moved to the back of the car and combined with the differential to form a transaxle. While this was not an issue for a manual transmission car, since Corvette was already sourcing its own six-speed, the cost to tool a bespoke automatic transaxle could be prohibitive. By way of a resolution, Chevrolet Research and Development engineer Laslo Nagy created the specifications for the automatic and asked GM's Hydra-Matic Division how much it would cost. The answer was slightly shocking—$80 million, according to McLellan, which represented at least half of the anticipated total cost to create the new car. There was no possible way to amortize this amount of money for a Corvette-only automatic transmission, but McLellan didn't let that stop the process of creating a new Corvette from moving forward. He also didn't let the absence of approval and the necessary funding for a new-generation Corvette stop the process, even though amidst ongoing financial struggles during the 1980s and into the 1990s, the new Corvette, which was originally slated for introduction in 1993, was repeatedly delayed.

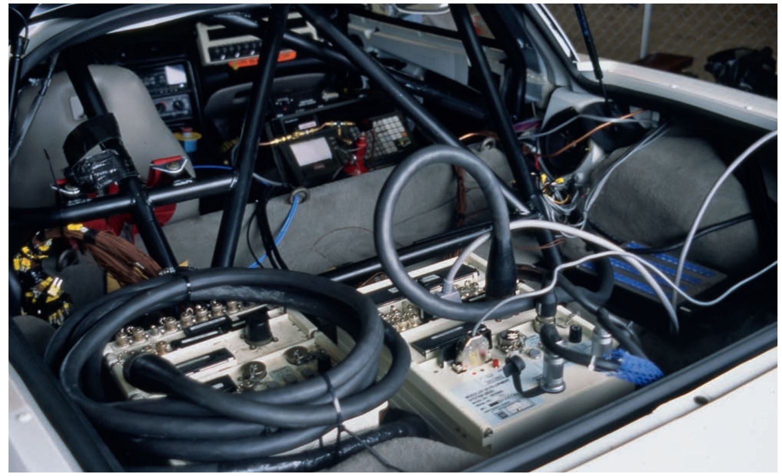
Optimistic that GM would eventually greenlight C5 and provide the necessary funding, McLellan began assembling the group that would engineer the car. Doug Robinson, Corvette development manager for C4, was appointed team leader. Several highly experienced specialists were sourced from Chevrolet Research and Development, which was then led by Tom Wallace, including structural analysts Steve Longo and Brian Deutchel, packaging engineers Al Bodnar and Dick Balsley, and the aforementioned transmission designer, Laslo Nagy.

As the Corvette engineering group was coming together, GM Powertrain's Jim Minneker hit upon a miraculous solution to the automatic transaxle cost dilemma. Minneker, who had played a key role in the engines that powered C4s, including the LT1, LT4, and LT5, and who was also intimately involved in racing C4s, was a devoted Corvette supporter determined to find a way around the transaxle issue. He learned that work was already underway at Hydra-Matic to design a new, more rigid automatic transmission housing to overcome a vibration problem in GM's full-size four-wheel-drive trucks. This new housing could be easily adapted to an automatic transaxle for Corvette, and the truck program, which represented a huge portion of GM's overall sales and was therefore well funded, would pay almost all the development and tooling costs.

With the automatic transaxle problem behind them, the engineering team focused all their energy on designing a backbone structure for the new car. This is where new technologies, unavailable a decade earlier when C4's structure was being designed, came into play. The design engineers and structural analysts worked together to overcome each obstacle. Lead Corvette body engineer Jerry Fenderson realized that the outer rails could be made from one long section of steel rather than three separate sections. Starting with 15-foot (4.572-meter) long, 6-inch (15.24-centimeter) diameter seamless tubes made from 0.08-inch (0.2032-centimeter) thick steel, the rails could be precisely shaped by hydroforming. This innovative process first bent the tube into its approximate desired shape using conventional roll bending, then finalized its shape by capping both ends, placing it inside a die, and injecting water into the tube at approximately 10,000 psi. The immense hydraulic pressure inside the tube expanded it to exactly conform to the die.

The two hydroformed side rails were tied together by front and rear cross members, and by the central backbone tunnel, crafted from sheet steel and welded to the rails behind the engine and ahead of the transaxle. Front and rear suspensions were similar, with forged aluminum upper and lower control arms at all four corners. The upper arms mounted to

◀ Stylists in the Corvette Production Studio, under the leadership of John Cafaro, met all engineering requirements and navigated through consumer clinics to create a beautiful exterior design for C5.



▲ Engineers continually refined C5's ride and handling characteristics by pushing them to their limits on racetracks, including VIR, where this thinly disguised test mule was photographed.

▶ The development of highly sophisticated computer hardware and software enabled engineers to dramatically improve every aspect of the C5's ride and handling during over-the-road and track testing.

the main structure and the lowers mounted to large cast-aluminum cradles. The front cradle held the engine, the rear held the transaxle, and both cradles bolted to the chassis, further strengthening it. With this design, the engineers were confident they had solved all major structural and packaging challenges, and advanced computer analysis late in 1992 predicted they were right. The next step was to build an actual car to validate the design, but Dave McLellan would not be there to oversee that. Having retired on August 31, 1992, he agreed to stay on through the end of the year. On November 18, 1992, Dave Hill took over as Corvette chief engineer.

The first prototype to test the new structure was completed in early 1993 under the direction of Jon Moss. As the mockups had already shown, compared with C4 the new design offered increased passenger room as well as easier entry and egress. And, as the computer modeling tools predicted, it was incredibly rigid, compared with C4 and any other car then in production. First torsional frequency, which is usually an accurate indication of noise and vibration characteristics, topped out at 17Hz for the era's best European luxury cars with a removable top. A C4 coupe, without its Targa top, measured 13Hz. By comparison, the first C5 coupe prototypes measured an astounding 23Hz, meaning they were more rigid by a wide margin than any other production car with a removable top then in existence, and fully four times stiffer in torsion than the C4.

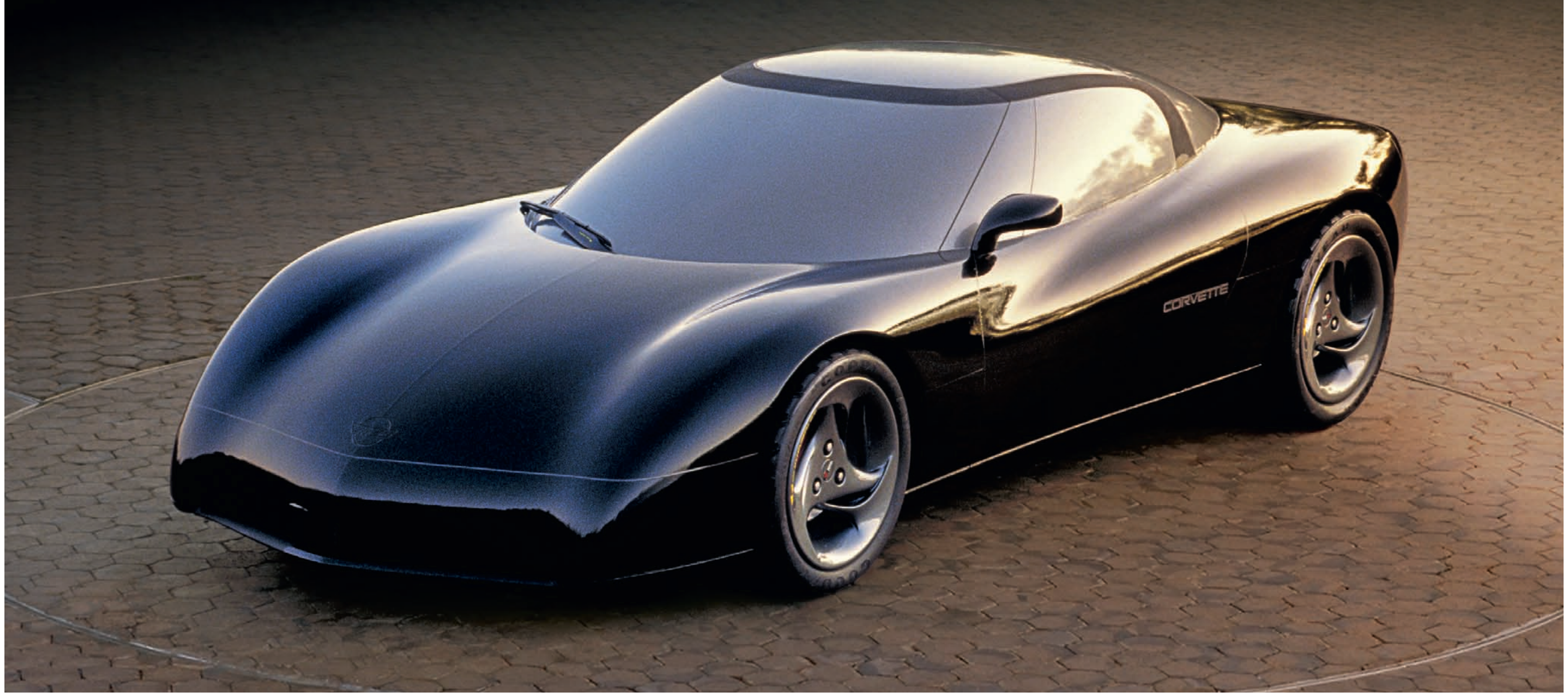
STYLING THE C5

While engineering was getting ramped up, GM Design leader Chuck Jordan launched an internal competition to explore styling ideas for a new Corvette. John Schinella's group at the Advanced Concepts Center in Thousand Oaks, California, prevailed in the first round and their design, called *Stingray III*, was built as a running prototype. Though in some ways this car influenced the direction C5 styling took, it was a pure concept too impractical to reach production for several reasons, starting with its V-6 engine.

As the internal design contest progressed beyond the first round, some fifty or sixty scale models were produced, representing a broad range of ideas for what the next Corvette should look like. At a Corvette future product review on the Design Center patio, many of these models, as well as many drawings, were displayed for the entire Design Center staff and executives, and two of the models that stood out from the others were chosen to move forward.

One of the designs selected was from Tom Peters. Though it bore a resemblance to the *Stingray III*, it was fresh, beautiful, and practical enough for production. The other design came from John Cafaro, head of the Corvette Production Studio, and it offered an innovative, forward-looking interpretation of how the next Corvette might appear.

◀ A few of the many C5 design proposals that were built as scale models over a period of several years as work on the fifth generation started and stopped several times because of GM's delay in approving the new car.



▶ This stunning design from John Cafaro and his Corvette Production Studio team, called *Black Car*, emerged as the winner of a comprehensive, company-wide design competition for C5, but was not well received in focus groups.

As was the case for every Corvette design he created during his long career with GM, the starting point for Cafaro was racing. He found great beauty in the uncompromisingly functional form the most successful race cars necessarily adopted and was inspired by past models as well as more current racers, including the Spice-Pontiac IMSA GTP he had designed, and the Peugeot 905 Evo 1Bs that won back-to-back victories at Le Mans in 1992 and 1993. When envisioning the C5, Cafaro thought about the requirements for optimizing its body for a racetrack and how he could make that form language beautiful and feasible for a road car, an approach he cultivated over the years with guidance from veteran GM designer Randy Wittine. Working in the basement of the Design Center in a somewhat remote area that came to be called the *Skunk Works*, Cafaro refined his vision until it was ready to be rendered as a full-size clay and then a fiberglass appearance model, which was called simply *Black Car*.

"*Black Car* was a very pure statement, inspired by various race cars more than anything else," recounts Cafaro, "and a lot of credit goes to David Snabes, a GM Design sculptor who modeled both the scale and full-size clays of the car, and beautifully brought to life what I was trying to express."

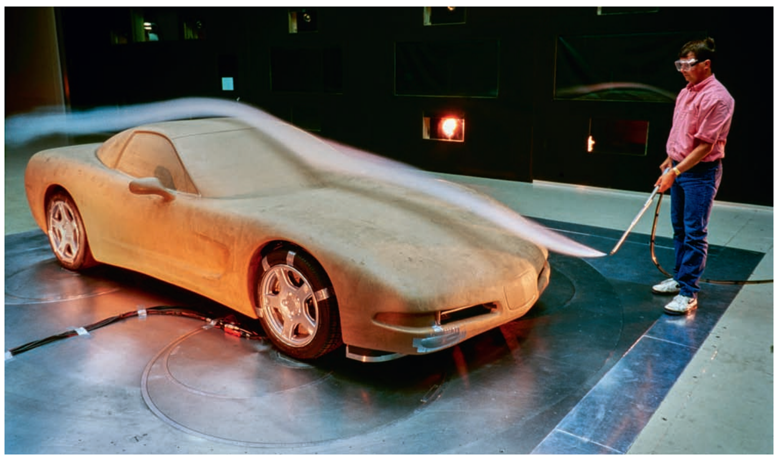
Many at GM thought the *Black Car* was a strong and stunning design that should be the next Corvette, but there were forces working against them. GM's long delay in approving C5, which resulted in work getting underway and then stopping several times, didn't help, and the design work was also significantly impacted by market research studies and consumer clinics, which was a first for Corvette. The clinics, according to both Cafaro and McLellan, were not always helpful. McLellan later wrote that the incredible designs Cafaro produced lost some of their edge because of consumer opinions, and Cafaro describes the process of integrating input from disparate sources, including focus groups, as a painful experience.

"*Black Car* was very refined," Cafaro reflects, "and there was a certain purity to its beauty, but when you came up to the car and looked at it closer, it was really a brutal design. In the clinics, most people didn't understand it."

Besides having to navigate their way through "design by committee," the stylists had to contend with a long list of engineering considerations that were not part of the equation when prior Corvettes were created. Even with all of these complications, however, Cafaro's final design for C5, completed with assistance from the Corvette Production Studio team, including Randy Wittine, Mark Kaski, and Dan Magda, was quite successful. Most people saw it as beautiful, thoroughly contemporary, and even forward-looking in some ways. But at the same time it retained several signature design features, including hideaway headlights and four oval taillights, so there was no mistaking that this was indeed a Corvette.

As important as how the new body looked was how it performed. Extensive computer modeling and wind tunnel testing resulted in an industry-leading 0.293 coefficient of drag. Innovative thinking and excruciating attention to detail, particularly regarding the car's mirrors and rear fascia, were what yielded that number, which was lower than any car then in production.

Cafaro points to the C5 design's functionality as his favorite part of the car. "The most satisfying part of C5 was its aero balance and performance," he tells us. "When the car was introduced, people didn't know we were going racing with the C5, but that was a big factor in the design and seeing the car perform on track with great success, and knowing that we got it right, that's the most satisfying part for me."



STYLING THE C5 INTERIOR

As with the rest of the car, design of C5's interior was interrupted several times, mostly because of GM's deep financial troubles in the late 1980s and 1990s. When work did finally get underway, a team led by engineer Jon Albert set out to improve every aspect of the new Corvette's interior while still retaining a clear connection to the nameplate's heritage.

Because of the car's innovative central-backbone design, they were able to eliminate the tall door sills used to partially solve C4's rigidity problems. The all-new C5 chassis and body structure also allowed for a more spacious interior, with about 1.5 inches (3.81 centimeters) of additional headroom and 3.4 inches (8.64 centimeters) of added hip room.

The fit and finish of interior trim and the overall quality improved noticeably compared with C4, with softer, more sophisticated materials replacing most of the hard plastic pieces seen previously. The C5 interior was also noticeably quieter, owing to improved insulation, more precise component fit, and the car's greatly enhanced structural integrity.

In a nod to past Corvette interiors, and undoubtedly in response to the fact that most people simply didn't like the flat panel LED displays used in C4, C5 went back to round, analog gauges. Also reminiscent of earlier Corvettes, especially C2s, the twin-cockpit design used arches over both the driver side instrumentation and passenger side dash area.

POWERING THE C5

The most competent body structure and most efficient aerodynamic qualities aren't going to launch a car to the top of the mountain without a powerful engine. C5's came in the form of a completely new Gen III Chevrolet small-block called LS1.

In 1991, when the Gen II LT family of engines was just going into production, GM had allocated $1.2 billion for renovations of its Flint, Michigan, engine plant. The Flint facility had been producing small-block V-8s for Corvettes since 1955, and it

▲ Corvette Production Studio leader John Cafaro evaluates the just-milled surface of a full-size C5 clay while studio sculpting manager Claudio Bertolin, *standing*, and designer Dan Magda, who played an important role in styling the car, look on.

◀ Aerodynamic performance played a strong role in C5's appearance, particularly the rear end treatment, mirror design, and other surface details.

needed a complete overhaul and replacement of most of its tooling. Executive Director of GM Powertrain Tom Stephens saw this as an opportunity to design a completely new family of engines and tool up a new, thoroughly modern plant to build them. He assured company leadership that his team could do this for no more than it would cost to revamp and retool the old plant.

To that end, late in 1991, Stephens tasked the engineers in GM Powertrain's Advance Design group, including Alan Hayman, Jim Mazzola, and Tom Langdon, with defining a new engine's major specifications. Under the leadership of Anil Kulkarni initially, and then Ed Koerner, this group, headed by John Juriga, began by taking the most innovative elements from a new six-cylinder engine, called Venture V6, that they were already working on and moved forward from there.

The engineers knew from the beginning that cylinder head design was critical to meeting the new engine's power and efficiency goals. Ron Sperry was in charge of the heads and put together a team that included computer modelers Chuck McGuire and Jerry Clark, valvetrain authority Jim Hicks, and airflow specialist Alan Hayman. Ron Sperry also recruited his brother, Ken Sperry, whose decades of experience made him one of the world's top port airflow experts.

After intensive computer modeling, dyno evaluation, and in-vehicle testing, the Gen III engine was completed and ready for release in the C5. It retained the same basic architecture as its predecessors, including a single camshaft in the block with pushrod-actuated valves and 4.40-inch (11.18-centimeter) cylinder bore spacing, but otherwise it was entirely new.

The foundation of the Gen III engine family, its block, was a deep-skirt, closed-deck design made from aluminum with ultra-thin, cast-in cylinder liners. Four-bolt main bearing caps were cross-bolted to the block for ultimate strength. The new block was far stronger than any of its predecessors and weighed only 107 pounds (48.53 kilograms), compared with 195 pounds (79.38 kilograms) for the LT engine block.

The LS cast-aluminum oil pan was a structural member, and cast-aluminum cylinder heads used roller lifters and roller rockers to minimize friction. The head castings featured relatively tall and narrow cathedral-shaped ports that were identical, providing even flow to all cylinders. The unusually shaped ports delivered the desired volume and flow in the space available between the head bolts and inline push rods and allowed for optimum placement of the fuel injectors. The intake manifold was composite, which made it lighter and

▶ C5 interior design, led by Jon Albert, went through numerous iterations before arriving at final production, which retained the twin-cockpit motif initiated in 1963.

▶▶ C5 Corvettes were powered by the new Gen III LS1 V-8 packed with weight-saving features, including a deep-skirt aluminum block with cast-in cylinder liners, aluminum heads, composite intake, hollow camshaft, and stainless headers.

better flowing than any previous example and helped insulate the intake charge. The camshaft had a hollow core for reduced mass.

After forty-plus years of Chevy V-8s using essentially the same oiling system, even this was revamped for the new engine. The oil pump was relocated to the front of the engine and driven from the camshaft, which took a full inch (2.54 centimeters) off the engine's total height.

The new engine's innovative mechanical components were complemented by a host of improved electronic systems. The ignition system was now distributorless, and each cylinder had its own coil, with all eight synchronized by the engine's computer. The cylinder firing order was changed from 1-8-4-3-6-5-7-2 to 1-8-7-2-6-5-4-3 to reduce vibration and stress on the engine's bottom end.

In its final form, the Gen III V-8, which was manufactured in Romulus, Michigan, brought Chevrolet's venerable small-block engine to new heights of performance. All the innovative engineering and careful choice of materials had yielded the smoothest running, cleanest burning, most fuel efficient, most reliable, most durable, and most powerful small-block Chevy produced up to that point.

THE FINISHED CAR

The foundation for C5's excellent all-around performance was, both literally and figuratively, its central backbone body structure, which dramatically enhanced ride and handling characteristics by allowing engineers to precisely tune the car's independent suspension for driver control with freedom from impact harshness. All of this helped to provide linearly progressive feedback, which is important because it allows the driver to know when he is approaching the car's adhesion limits on the road surface.

Enhancing the new Corvette's fundamentally good structural design were its integrated electronic chassis systems. Advanced anti-lock braking enabled the car to stop sooner under nearly all imaginable situations and allowed for continuous directional control by minimizing wheel lockup. Aiding safety as well as performance was an ultrasophisticated traction control system. As with its ABS, C5's traction control did not take away torque and shut the car down when trouble arose; instead it intruded just enough to allow the driver to maintain or regain control. And the electronic real-time damping suspension option, introduced in 1996 at a cost of $1,695.00, was carried over to the new car, allowing a control module to alter the damping characteristics of special shocks based on instantaneous feedback from wheel travel sensors.

▲ C5's fundamentally sound structure and sophisticated electronic chassis controls, including ABS brakes, traction control, and real-time damping, combined to deliver unprecedented levels of handling and safety.

The compact, lightweight Gen III LS1 engine introduced in 1997 took full advantage of Corvette's new structure and sophisticated electronics. Its 345 horsepower and 350 lb-ft (520.86 kilograms per meter) of torque propelled the new car from 0 to 60 miles per hour (0 to 100 kilometers per hour) in 4.8 seconds, tripped the quarter-mile lights in 13.2 seconds at 110 miles per hour (177.028 kilometers per hour), and topped out at 172 miles per hour (276.81 kilometers per hour).

Combined, all of the advances incorporated into it catapulted C5 to the very forefront of the world's greatest performance cars. Finally, enthusiasts had a Corvette that did absolutely everything well with no excuses whatsoever.

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THE TRIUMPH OF TECHNOLOGY

1998–2004

The C5 was introduced as a coupe only, but by the beginning of the 1998 model year, a convertible was offered. Because C5 was designed as a convertible from the beginning, no additional structural support was needed, and even in drop-top form the newest-generation Corvette could handle the roughest of roads without any complaints.

◀ The C5 Z06 had bespoke wheels 1 inch (2.54 centimeters) wider than coupe and convertible wheels, shod with Goodyear Eagle F1 SC tires that were wider, stickier, and lighter than the Eagle F1 GS EMT tires on coupes and convertibles.

A third model, dubbed hardtop, joined C5's lineup in 1999. It was initially intended to have fewer standard features than either coupes or convertibles and as such be the lightest weight and lowest priced of the three. Though plans to install cost-saving items like cloth seats and manual door locks were ultimately canceled, the hardtop still ended up being the least expensive and lightest Corvette. It also wound up being the best performer owing to its lower mass and greater stiffness.

Corvette's handling capability took a big step forward with the introduction of F45 Active Handling, a $500.00 option made available in the middle of the 1998 model year. Active Handling was the logical outgrowth of highly functional anti-lock braking and electronic traction control, first made available in C4 Corvettes. It relied on data from onboard sensors that measured yaw, lateral acceleration, brake pressure, and steering wheel position. This information was processed by a computer that recognized when the car was entering a severe oversteer or understeer situation and employed individual wheel braking to rotate the car in the direction intended by the driver.

First-generation Active Handling, introduced in mid-year 1998, was good, but the second-generation system, which became standard in 2001, was much better. The newer version relied on an improved brake pressure modulator and a host of new or revised computer calibrations to deliver a system that was both less intrusive and more effective.

In 2001 C5 performance took a big step forward with the introduction of the Z06 model. Chevrolet chose to use the hardtop as the starting point for Z06 because it was the stiffest (by 12 percent) and lightest (by 80 pounds [36.29 kilograms]) model in the lineup. All Z06s were powered by an engine called LS6. It featured improved bay-to-bay breathing via cast-in windows in the block; pistons cast from high-strength M142 aluminum alloy; new, better breathing intake and exhaust manifolds; new cylinder head castings; a more aggressive camshaft, higher-rate valve springs for a higher redline; and higher-capacity fuel injectors.

The LS6's initial rating was 385 horsepower, but output grew to 405 horsepower in 2002. The gain came courtesy of new catalytic converter technology that reduced back pressure.

▶ The hardtop model served as the base for the Z06, introduced in 2001, because it was both stiffer and lighter than a coupe or convertible.

With less back pressure, engineers were able to make further gains on the induction side with a new air cleaner assembly, a new mass airflow sensor, and a higher-lift camshaft.

More power was only one element of what made the Z06 model Corvette's performance leader. Another factor was the car's unique six-speed manual transmission. Called M12, it had more aggressive gearing and a temperature sensor to help protect it from higher thermal stresses. Z06 also had its own suspension system, called FE4. It featured a larger-diameter front stabilizer bar, stiffer rear leaf spring, and revised camber settings, all calibrated with a bias toward maximum control during high-speed operation.

Further aiding Z06 performance were special wheels and tires. Besides being an inch (2.54 centimeters) wider, the uniquely styled wheels were the most mass-efficient ever produced for Corvette to that point, which is to say their strength-to-weight ratio was the highest. These light yet strong wheels wore Goodyear Eagle F1 SC tires that were wider and stickier than the Eagle F1 GS EMT tires on coupes and convertibles. The Z06 tires were also lighter than their counterparts, reducing mass by 23.4 pounds (10.61 kilograms).

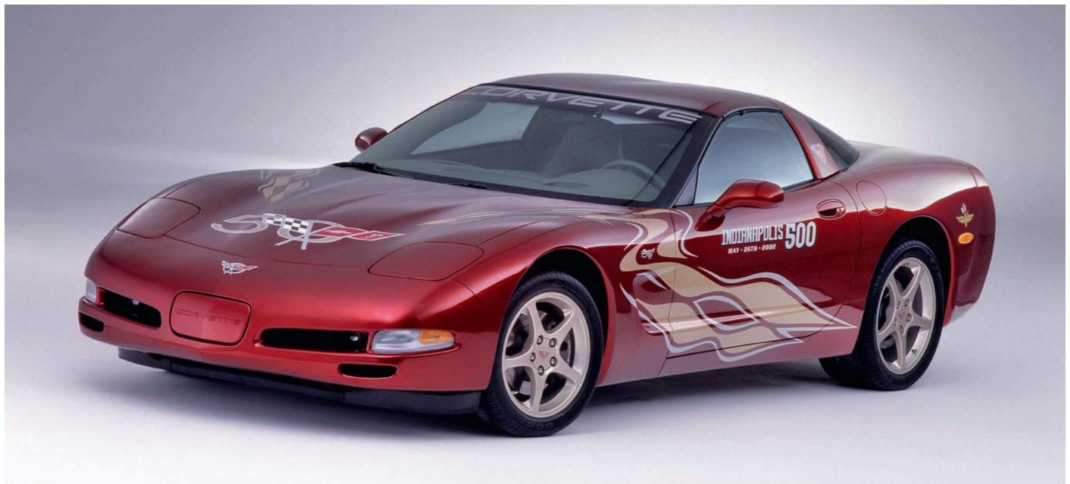
Besides lighter wheels and tires, Z06 also benefited from several other clever weight-trimming features. The first-ever use of titanium in the exhaust system of a mass-production car saved 17.6 pounds (7.98 kilograms) and another 5.7 pounds (2.58 kilograms) were trimmed off by means of a thinner windshield and backlight.

The stiffer structure, added power, more aggressive gearing, tweaked suspension, stickier tires, and reduced mass yielded the fastest, best-stopping, and best-handling Corvette to date. It did 0–60 miles per hour (0–60 kilometers per hour) in 3.9 seconds, turned 12.4-second quarter miles (0.402 kilometers), topped out at over 170 miles per hour (273.59 kilometers per hour), and generated 1.03 g of lateral acceleration. And all of this from a car that could take its owner to work and back every day in any weather with air conditioning, full power, and a great stereo system.

▲ When introduced in 2001, the Z06-exclusive LS6 engine was rated at 385 horsepower, but output climbed to 405 horsepower the following year thanks to a new catalytic converter, better-breathing air cleaner, revised mass airflow sensor, and higher-lift camshaft.

◀ The Z06 interior is distinguished from other model interiors by the checkerboard pattern on the tachometer and speedometer, as well as the Z06 logo on the tachometer.

▼ Handsome ducts on C5 Z06 rocker panels brought cooling air to the rear brakes.



▲▲ The 2003 50th Anniversary Edition option package, available for both coupe and convertible, but not Z06, included unique 50th Anniversary Red paint with Xirallic, a vivid pearlescent paint with aluminum oxide particles suspended under a tinted clear coat, from German manufacturer Merck KGaA.

▲ A 2003 50th Anniversary Edition Corvette coupe paced the 2002 Indianapolis 500, but pace car replicas were not available in 2003, as they had been each time Corvette had paced the race in 1978, 1986, 1995, and 1998.

SPECIAL EDITIONS

In keeping with Corvette tradition dating back to the 1978 Indy pace car replicas, Chevrolet produced several special edition C5s. The first came in 1998 when Corvette was once again chosen to pace the Indy 500. A total of 1,163 pace car replicas were sold that year, all convertibles and all painted Pace Car Purple with yellow and black interiors.

To help celebrate Corvette's golden anniversary, a 50th Anniversary Edition package was added to the option sheet for 2003. Priced at $5,000.00, the Anniversary Edition option included memory package, electrochromic mirrors, tilt and telescoping column, twilight sentinel, head-up display, magnetic selective ride control (MSRC), and special cosmetic treatment inside and out. The Anniversary Edition was available with coupes and convertibles, but not Z06s, in part because of the 13.2 pounds (5.99 kilograms) MSRC added.

The Anniversary Edition's special cosmetics were the only element of the package that couldn't be had on other 2003 Corvettes. Exteriors were painted 50th Anniversary Red with something called Xirallic paint, which was a multi-stage coating that yielded a particularly beautiful appearance. Champagne-painted aluminum wheels nicely complemented the Anniversary Red paint. Leather wrapped door pulls, embroidered seat back and floor mat logos, and a near-monochromatic color scheme called Shale distinguished 50th Anniversary Edition interiors.

To commemorate Corvette's fifth generation in its final year, and to celebrate the factory C5.R racing program's success, particularly at Le Mans, Chevrolet offered a Commemorative Edition for 2004. Distinguishing cosmetic features of this Z06-only package included unique Le Mans Blue paint with bold white racing stripes, red accents, and special badging. A carbon fiber hood further reduced mass of the already lightweight Z06 while suspension tweaks rounded out the performance upgrade.

▲ While most special edition packages offered for Corvette contained only cosmetic features, some did have performance enhancements, including the 2004 Z06-only Commemorative Edition, which included a carbon fiber hood and revised suspension tuning.

◀ Sophisticated computers, advanced design software, and brilliant engineering under the leadership of Dave McLellan, in conjunction with stunning design from John Cafaro and his team in the Corvette studio, made the C5 a world-class car in every measure.

ECOLE DE PILOTAGE
AUTOMOBILE CLUB DE L'OUEST
SARTHE l'esprit de compétition
A.C.O
CLUB DE
24
DUNLOP
DUNLOP
PAYS DE LA LOIRE
PAYS DE
CORVETTE
GMAC
Mobil 1
COMPUWARE
63
MOTOROLA
AN AMERICAN REVOLUTION
Mobil 1
COMPUWARE
64

21

CHEVROLET GOES RACING

WITH THE C5

The C5 was a completely redesigned car that radically improved performance in every measure. Director of GM Racing Herb Fishel correctly concluded that it would provide the foundation for a very successful production-based race car. In 1996 he asked Doug Fehan to write a proposal for GM to take the new Corvette racing. Fehan had managed GM's involvement in the Intrepid GTP program and, when that was winding down in 1992, he put together a presentation for a new Corvette-based program called *American Patriot*. Though well received by GM's top management, it was not approved, primarily because the company was in the midst of severe economic distress. In 1996 Fehan dusted off the *American Patriot* proposal, brought it up to date, and made a convincing presentation to GM's senior leadership. Shortly thereafter a full-factory-backed Corvette racing program was approved.

◀ At Le Mans in 2004, the Corvettes finished first and second in class and an impressive sixth and eighth overall, solidifying this team's reputation as the top GT program in the world.

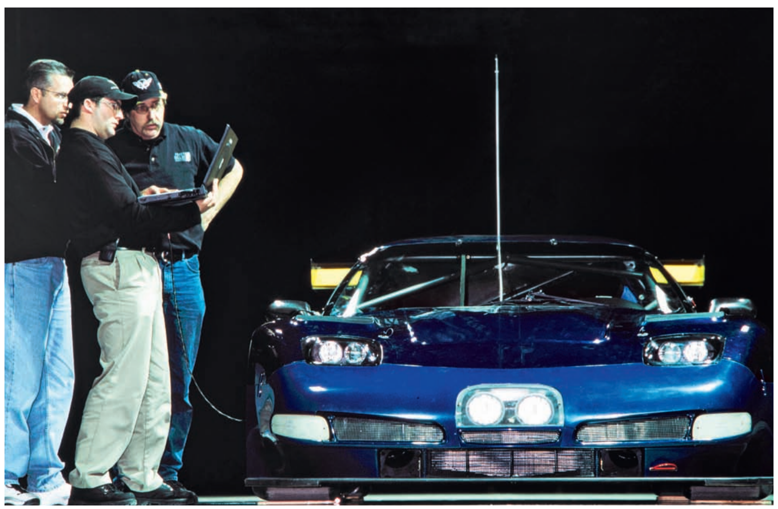
After considering several potential partners, GM Racing contracted with Pratt & Miller Engineering (PME) to design, build, develop, and race the cars. The union of master fabricator/race car builder Gary Pratt and race car driver/financier Jim Miller, who was instrumental in getting the Bob Riley–designed Intrepid built, formed PME. When the company was enlisted to build racing Corvettes for Chevrolet, it had a small shop with eight employees, a few toolboxes, a few machines, a fifth-wheel trailer, and a pickup truck to pull it. Fueled by the long-term vision of Miller and the deep racing experience of Pratt, they quickly grew, adding engineers, fabricators, working space, and specialized tools to get the job done.

A development mule for the new racer, first called C5-R and later C5.R, began testing in 1997. Ron Fellows, Chris Kneifel, Andy Pilgrim, and others completed extensive testing in 1997–1998 and toward the end of the test program PME employed everything they had learned to build the first two C5-R race cars.

Corvette Racing made its competition debut at the 1999 24 Hours at Daytona with PME running one of the cars and Riley & Scott running the other under contract to PME. Porsche dominated the GT2 class at Daytona, with Roock Racing's 911 taking class honors at the rain-soaked event. C5-R No. 2 was driven by Fellows, Kneifel, and John Paul Jr. to third in class while the No. 4 C5-R, piloted by Andy Pilgrim, Scott Sharp, and John Heinricy, finished a distant twelfth in class. The Corvettes' air filters were faulty and allowed Daytona Speedway's ever-present sand to get into the engines during the race. Over twenty-four hours the sand literally wore away the cylinder bores, causing loss of compression and excessive oil consumption. Still, the Corvettes finished this especially difficult endurance race, something all concerned considered a major accomplishment.

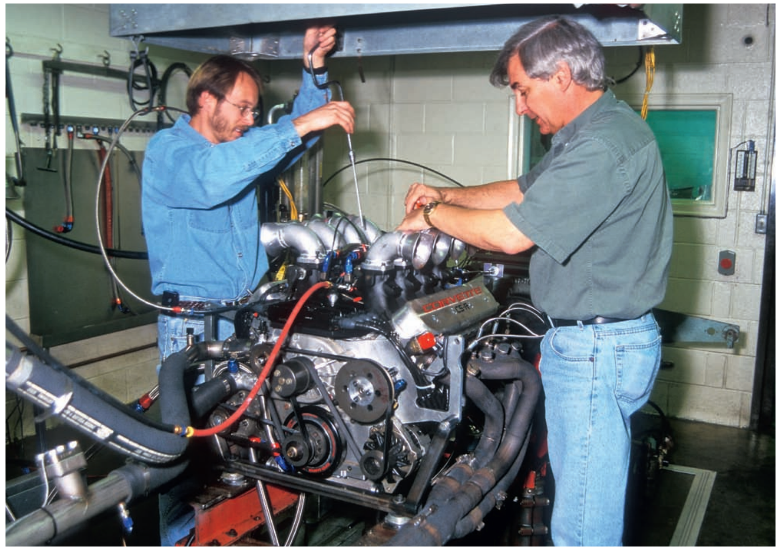
Following Daytona, Corvette Racing competed in four more events in the newly created American Le Mans Series (ALMS), beginning with the 12 Hours of Sebring, where Fellows/Kneifel/Paul Jr. finished fourth in GTS behind three Porsches. At Road Atlanta's Petit Le Mans, Pilgrim/Sharp/Kelly Collins finished fourth behind three of Dodge's all-conquering GTS-R Vipers. Three weeks later at Laguna Seca, Fellows and Kneifel earned the team's best finish of the year, second place behind the winning Viper. And at the final ALMS race of the year, at Las Vegas Motor Speedway, Fellows and Kneifel finished third behind two Vipers.

Though the C5-Rs didn't win any races in 1999, the team's potential was evident. The following year, the second in GM's three-year commitment, they competed in six ALMS races as well as Daytona and the 24 Hours of Le Mans. The first win came at Texas Motor Speedway on September 2, when Ron Fellows and Andy Pilgrim co-drove their C5-R to a convincing



▶ GM road racing group manager Steve Wesoloski, data acquisition specialist Donny Atkins, and race mechanic David James with a C5-R in GM's wind tunnel.

▶▶ Fabricators at Pratt & Miller started with the factory C5 chassis and, in accord with the drawings created by Chevrolet and Pratt & Miller design engineers—and in conformance with FIA homologation rules—built up the C5-R race cars.



◀◀ Despite looking rather exotic under the hood, the C5-R development car maintained considerable fidelity to the road-going C5, as required by FIA homologation rules.

◀ Kevin Pranger from Katech, Chevrolet's engine partner for Corvette Racing from 1997 through the middle of the 2009 season, and GM Racing engineer John Rice prepare a C5-R engine for dynamometer testing.

three lap victory over the Olivier Beretta/Karl Wendlinger Viper GTS-R. They were helped by the fact that this was a new venue for all competitors, so the Corvette team was on equal footing, in terms of track data, with their more experienced opponents.

They were also helped at the Texas race by intensely hot and humid weather, which sent several drivers to the hospital with heat exhaustion and even severe burns on their feet and legs. The ambient air temperature at the track when the race began was 112 degrees Fahrenheit (44.44 degrees Celsius), and temperatures in the front-engine, closed-cockpit cars, including the Corvette C5-Rs, Dodge Viper GTS-Rs, and Porsche 911 GT2s, which did not have air conditioning or any sort of driver cooling aids, exceeded 150 degrees Fahrenheit (65.55 degrees Celsius).

Recounting the win in Texas, Fellows said, "It was so hot in the car with the heat soak and lack of air circulation that it hurt to breathe!" Pilgrim's memory of the race is similar: "I had to keep moving my right foot to the left side of the gas pedal to stop my toes from burning on the firewall and I had heat blisters on both my feet at race end, which wasn't uncommon in the Corvette, but these Texas blisters and burns were way deeper." Despite his discomfort, however, Pilgrim has an unusual tolerance for heat and was able to perform at a higher level than any of the Viper or Porsche drivers, helping ensure the decisive victory.

Driven by strong leadership, GM Racing, PME, and engine partner Katech all evolved continuously and quickly in the early years of the factory Corvette race program. The deep technical resources of GM Engineering, combined with lessons learned from rigorous testing and on-track failures, produced increasingly better race cars that got lighter, wider, and more powerful. Equally important, the team continually improved by attracting and then holding top mechanics, engineers, and drivers. By 2001 the results were nothing short of spectacular. That year, Corvette Racing's Ron Fellows, Johnny O'Connell, Chris Kneifel, and Franck Freon bested all GT competitors and overcame a large prototype field to win the Rolex 24 Hours at Daytona overall. In full-season ALMS competition against several Viper GTS-Rs, a Prodrive Ferrari 550 GTS Maranello, and three mid-engine Ford-powered Saleen S7Rs, GM's full-season pairings of Fellows and O'Connell along with Pilgrim and Kelly Collins earned GTS honors in six out of eight races to secure the team and manufacturer championships. And on the international stage, Corvette Racing finished first and second at the 24 Hours of Le Mans with Fellows, O'Connell. and Scott Pruett taking the win.

▲ C4 Corvettes won every SCCA Showroom Stock Endurance Series race from 1985 to 1987, so SCCA changed their rules to eliminate their eligibility in 1988, leading to the creation of the Corvette Challenge series. Chevrolet cleverly referenced this when the C5 Corvette Racing program was unveiled in 1998.

▶ This elaborate ad explains the philosophy underlying Chevrolet's decision to add a fixed-roof coupe to Corvette's model lineup in 1999.

The team's success in 2001 played a strong role in GM's decision to renew the program for another year, and the 2002 results were equally impressive. The Corvettes won GTS in nine of ten ALMS races, including seven one-two finishes against a strong field of Saleens, Vipers, and Ferraris. They also recorded their second consecutive one-two finish at Le Mans, firmly establishing a reputation as the premier GT racing program in the world.

Going into Corvette's 50th anniversary year, there was no doubt that GM would again renew the race program for 2003 and beyond. Each year PME built new and improved C5-R race cars and over time the driver lineup evolved. Oliver Gavin signed on as a third driver for the long races in 2002 and was elevated to full-season status beginning in 2003. In 2004 Olivier Beretta joined as Gavin's full-season co-driver and Jan Magnussen was signed to drive with them at Sebring, Le Mans, and Petit Le Mans. That same year Max Papis partnered with Fellows and O'Connell for the endurance events.

When the fifth-generation Corvette yielded to the sixth-generation for model year 2005, the C5-R era closed with an astounding record of achievement, including overall victory at Daytona, three one-two class finishes at Le Mans, three class wins at Sebring, and, on the strength of forty-five victories in sixty-six races contested, four consecutive ALMS team and manufacturer championships and three consecutive driver titles.

▲ The C5-R program tested at numerous tracks in 1997 and 1998, including Sebring, Road Atlanta, and Gingerman, in preparation for its debut at Daytona in 1999.

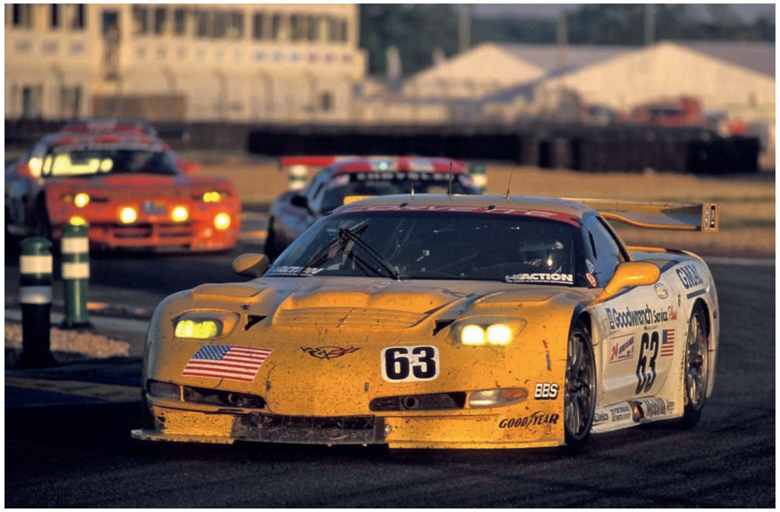
◀ Andy Pilgrim and Ron Fellows did much of the development driving for Corvette Racing when the program got underway.

▼ At Daytona in 1999, C5-R No. 2 drivers Chris Kneifel, John Paul Jr., and Ron Fellows celebrate their third-place finish with Chevrolet Racing Marketing Manager Gary Claudio, Corvette Racing Program Manager Doug Fehan, and Corvette Brand Manager Jim Campbell.

▶ The Chevrolet Corvette Racing program competed at Le Mans for the first time in 2000, with C5-R No. 64 finishing third in LMGTS and C5-R No. 63 close behind in fourth.

▶▶ Ron Fellows and Any Pilgrim co-drove to Corvette Racing's first class win in the American Le Mans Series Grand Prix of Texas at Texas Motor Speedway on September 2, 2000. Their No. 3 car was wearing an unusual color scheme, nicknamed Orca by the team because of its resemblance to a killer whale.

▼ The Corvette C5-Rs finished first and second in LMGTS at Le Mans in 2001, with the No. 63 car of Ron Fellows, Johnny O'Connell, and Scott Pruett earning the win.



▲ At Daytona in 2001, seventy-nine cars took the green flag, including twenty-three prototypes. When it was over, twenty-four brutal hours later, the No. 2 Corvette C5-R of Ron Fellows, Johnny O'Connell, Chris Kneifel, and Franck Fréon crossed the finish line first for the overall victory.

▶ At Le Mans in 2002, Corvette Racing overcame fierce competition from Ferrari, Viper, and Saleen to earn its second one-two finish in as many years.

▶ The No. 3 C5-R of Ron Fellows, Johnny O'Connell, and Franck Fréon won the 2003 Mobil 1 12 Hours of Sebring, finishing sixteen laps ahead of the second-place Veloqx Prodrive Racing Ferrari 550-GTS Maranello.

▼ At Le Mans in 2003, the Corvette C5-Rs wore patriotic red-white-and-blue livery and special numbers to honor Corvette's fiftieth anniversary: No. 50 for fifty years and No. 53 for 1953, the first year Corvette was produced.

▼▶ Testing throughout the years, in this case at Sebring in February 2004, has played a strong role in Corvette Racing's unequaled success.

▲ At the 2004 Mobil 1 12 Hours of Sebring, Johnny O'Connell, Ron Fellows, and Max Papis drove the No. 3 C5-R to first in GTS and a remarkable fourth overall, behind three of Audi's all-conquering R8 LMP1 prototypes and ahead of forty other entries.

{ Corvette takes on the world in the greatest endurance race of all time, the 24 Hours of Le Mans. }

Sooner or later, all great cars end up at Le Mans.

by Ken Brown, Corvette Production and Race Car Engineer

It was bound to happen. Simply a matter of time. One of the world's great sports cars taking part in the world's greatest endurance race. Corvette® is going to the 24 Hours of Le Mans to take on the world.

{ Many parts from our production car can be found on our Le Mans race car. }

The pressure is on.

The decision to return the Corvette to racing brought with it an incredible amount of pressure: pressure to make certain the new Corvette lived up to its legacy of racing dominance. A tradition that includes several impressive trips to Le Mans in the past. Once again, the pressure is on to conquer Le Mans.

The making of a world beater.

We were lucky. The Corvette gave us a lot to work with right out of the box. So when the Corvette C5-R first attacks Le Mans' Mulsanne Corner, it will do so with many of the same parts found on the production car. In fact, the production car was used as the starting point for the race car's bodywork. The C5-R uses the production hydroformed frame as a base for the roll cage. As for the suspension, the front and rear chassis cradles, the lower front control arms, and the rear lower control arms are the same as the production car. We even used a production windshield, door handles, taillamps and marker lights. The C5's long wheelbase and low center of gravity make it hold the road as if it were on rails. And with the C5's already aerodynamic styling, rigid body structure and tremendous suspension geometry, we were well on our way to building a race car capable of going to Le Mans and taking on the best the world has to offer.

{Modifications turned our production LS1 engine into a 600-horsepower powerplant.}

Now we have to make it move.

Yes, we did have a pretty good start at creating a race car. But now we needed to power this vehicle. We needed to find an equally incredible engine. Once again, our search led us to our production car. We simply had to look under the hood. The LS1 engine carries on the strong tradition of Corvette powerplants. Of course, the C5 had to be modified to reach race standards. But again, we were lucky. We were able to take the aluminum small-block from the production car and increase it from its original 345 horsepower to a whopping 600 horsepower.

Now the hard part.

After building the C5-R it was time to hit the road. Four thousand miles of testing later, we entered the Corvette in the GT2 category. This series was a perfect fit for the C5-R since the cars are more like road cars and the courses are more like actual roads. We brought our '40,000 production car-turned-race car, and put it up against vehicles from around the world that cost two-to-four times that price in the showroom. In its debut race, the grueling Rolex 24 at Daytona in January 1999, the C5-R not only showed up, but it completed the race and gave the rest of the pack a run for its money. It ended the season with several podium finishes. With each race we learn a little more. Every lap brings us closer to Le Mans. So when the race begins on June 17, Corvette will be ready to face the challenge.

Vive la Corvette!

Corvette has been there before. We know the course. We know what we have to do. Now it's time for the C5-R to take on the world. Everything up until now has simply been a warm-up for the granddaddy of all endurance races, the 24 Hours of Le Mans. If you can't make it to Le Mans, check out the production car that inspired the race car at your dealership or go to our web site: **chevrolet.com/corvette**. You can also see the Corvette live in action at Le Mans at **chevrolet.com/corvette/lemans**.

{ No stranger to Le Mans, in 1960, Corvette marched on to an impressive finish. }

The Only Sports Car That Matters.

CORVETTE

Call **1-800-950-2438** or visit **chevrolet.com/corvette**. ©2000 GM Corp. For Corvette racing merchandise, call 1-800-735-0432.

▲▲ Chevrolet announced that it was bringing the C5-R program to Le Mans in 2000, realizing a long-held dream of GM Racing Director Herb Fishel and others at the company who believed in racing as both a development and marketing tool.

▲ Fewer than five months after their very first class win, the Corvette team earned overall victory at the Daytona 24 Hour race, a remarkable accomplishment for a production-based GT racer.

22

EVOLUTION, NOT REVOLUTION

C6 INTRODUCTION, 2005

When the public first saw the C6 Corvette in January of 2004, many had the same initial reaction. Though obviously tweaked in many ways, the new car looked similar—suspiciously similar—to the old one. So much so that some immediately started calling it C5.5 rather than C6. Those responsible for the new car were well aware that it was perilously close to C5 in its overall look and feel, and they took every opportunity to point out that 85 percent of the new car by mass would not interchange with the same parts in the old car. Corvette Chief Engineer Dave Hill called the process of improving many areas of the already great C5 "building on success."

◀ The C6 convertible used the same structure as the coupe and was available with a power top, last offered for Corvette in 1962.

▼ The C6 chassis was extremely similar to its predecessor, but the front of each hydroformed rail was 2.4 inches (6.09 centimeters) shorter and the front bumper beam was .63 inch (1.6 centimeters) shorter front-to-rear.

▶ Though they look nearly identical to the components used for C5, the C6 cast-aluminum cradles, forged-aluminum control arms and knuckles, transverse composite springs, dampers, bushings, stabilizer bars, and steering gear were all redesigned.

C6 STRUCTURE

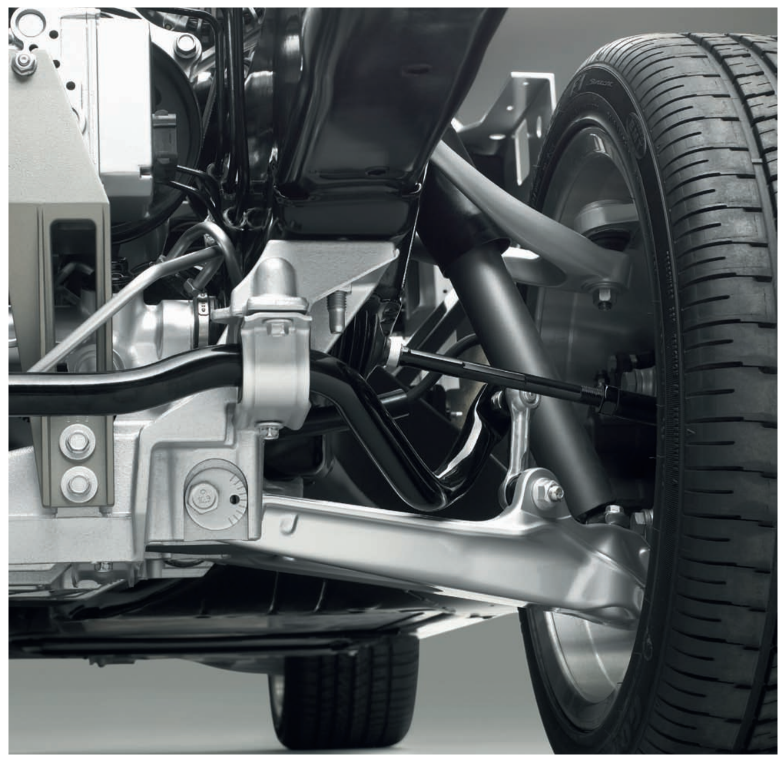
The C6's structure was nearly identical to its predecessor's, though slightly shorter with a number of small refinements that increased rigidity. The C5's independent suspension design also remained the same, but the cast-aluminum cradles, forged-aluminum control arms and knuckles, transverse composite leaf springs, dampers, bushings, stabilizer bars, and steering gear were all redesigned. The most notable results were improved handling and ride with lower weight.

The choice of three different suspensions carried over from C5, but all were refined, thanks in large measure to extensive testing, led by ride and handling development engineer Mike Neal and his colleagues. "Overall, the 2005 Corvette is less touchy, it's less tuggy, it's better isolated, it's quieter for road noise," said Neal. "It's all of those things and still a better handling car. Handling is our first priority in the Corvette."

In addition to the standard setup, buyers could choose F55 Magnetic Selective Ride Control or Z51 performance package. The optional F55 suspension, which cost $1,695.00, featured magneto-rheological shocks that instantaneously adjusted their damping rates in response to changes in the road surface. The system's hardware and software were updated to create more differentiation between the tour and sport settings.

Extensive track testing led to a host of improvements to the optional Z51 suspension, which added $1,495.00 to the cost of a new C6. The package included higher-rate springs, more aggressive dampers, larger stabilizer bars, and larger brakes. Cast aluminum wheels manufactured for Chevrolet by Speedline increased 1 inch (2.54 centimeters) in diameter to 18 inches (45.72 centimeters) up front and 19 inches (48.26 centimeters) at the rear, giving more room for bigger calipers that were stronger across the bridge, as well as larger-vented and cross-drilled rotors. The bigger-diameter rotors had more mass, which gave better fade resistance, and dramatically increased airflow to both the front and rear brakes also helped avoid fade in even the most demanding conditions. Taken together, changes to the Z51 package gave C6 track performance that was extremely close to the C5 Z06, but at a lower cost and with a more comfortable ride.

With or without an optional suspension, C6 handling and ride quality were significantly improved by new tires. Working closely with Goodyear, Corvette's exclusive OEM tire



◀ The tense, athletic, crisp lines of the C6 body brought design up to date, while the arched fenders, side cove with air-extracting fender vents, long hood, expressive face, and round taillamps all contributed to making it unmistakably a Corvette.

supplier since model year 1978, engineers helped develop next-generation run-flats that did everything better than their predecessors.

Run-flats must necessarily have stiff sidewalls in order to support the car's mass when deflated. But after a point, stiff sidewalls diminish handling by reducing the tire's grip under load. They also dictate unwanted compromises in chassis setup and suspension tuning to make loss of grip under load more linear and to mitigate the harsh ride the rigid walls provide.

One way Goodyear and Chevy engineers navigated around the stiff sidewall conundrum was by developing new algorithms for the now-standard Active Handling. The stability control system stepped in sooner and with more determination when a low-tire-pressure signal was received. In so doing it reduced the demands placed on a deflated tire, which in turn justified going to a more resilient sidewall design.

The improved tires gave a more compliant and thus more comfortable ride. This empowered engineers to increase roll stiffness by, among other things, specifying larger stabilizer bars and tuning shock valving more aggressively. This elevated the new Corvette's handling characteristics while overall ride quality was improved. The more comfortable ride was particularly noticeable with Z51 optioned cars, which felt closer to standard suspension C5s on bumpy and uneven roads.

C6 EXTERIOR

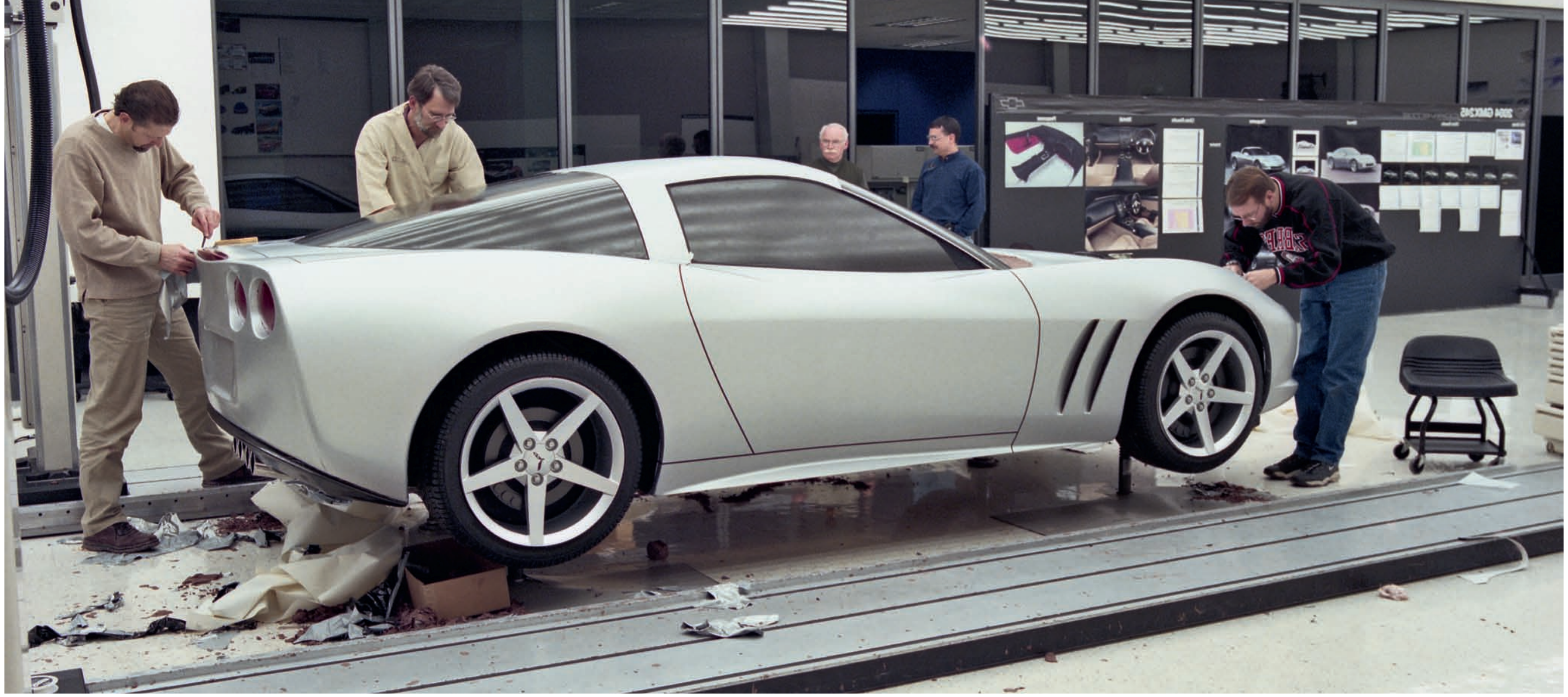
The C6 exterior styling was largely a collaborative effort between Tom Peters and Kirk Bennion. Peters led the overall design effort and saw to it that the car was beautiful and that it resonated with Corvette enthusiasts. Complementing this, Bennion handled more of the technical side of design, developing the car's aerodynamics and other functional considerations to apply the required engineering criteria while simultaneously respecting the aesthetics of Peters' vision for where the car needed to go.

Though the final C6 exterior is somewhat like the C5, every panel on the new car was changed. The design, which was reportedly influenced by fighter aircraft like the Lockheed/Boeing/General Dynamics YF-22, featured sharp creases and noticeably more angularity replacing the C5's rounded look, which characterized body styling in the 1990s. The new car also featured exposed headlights, last found on Corvettes in 1962. Advances in crash attenuation for the structure and improved packaging for everything that needed to fit under the body enabled Peters to make the C6 5 inches (12.7 centimeters) shorter and 1 inch (2.54 centimeters) narrower than C5.

Initially, the reduced dimensions threatened to harm aerodynamic performance, but extensive computer modeling and more than four hundred hours of intense wind tunnel testing ultimately resulted in a slightly lower drag coefficient of 0.286 compared with the C5's figure of 0.290.

▶ A full-size C6 clay comes to life with help from Kirk Bennion, at far right, and others at GM Design.

▼ The C6 got a new, lower-mass, 400-horsepower Gen IV V-8 called LS2 with a larger bore that increased displacement to 6.0 liters.



C6 INTERIOR

Dissatisfaction with the fit, finish, and quality of materials used for Corvette interiors grew significantly in the 1970s, and because consumer expectations continually rose, improvements to C4 and C5 interiors did little to stem the criticism. As a result, Chevrolet devoted more resources to the C6 interior than usual. The doors were made stiffer, had better seals, and, like the rest of the cockpit, benefited from increased use of sound-deadening material. Seats were more comfortable and supportive, and entry and egress became easier because the windshield was more upright than in the previous car.

The instrument panel surround and door trim were made with something called cast skin. Meant to simulate leather, it had a soft glow, uniformity of color, and fit that was noticeably nicer than what was used previously. The improved trim material was complemented by anodized aluminum accents with a screen-printed appliqué on the center stack, manual shifter knob, and door release buttons. More stowage room in the door panels and center console was a welcome change, and the new Bose sound system was better than what was available in the C5. Keyless access with push-button start, which was previously offered in the Cadillac XLR, was available for the first time in Corvettes.

POWERING THE C6

Continuing the progression initiated with the C4, when technology began overcoming increasingly stringent emissions and fuel consumption mandates, C6 got a new Gen IV V-8, called LS2. Stroke remained the same as LS1 at 3.62 inches (9.19 centimeters), but bore went from 3.90 to 4.00 inches (9.91 to 10.16 centimeters), increasing displacement from 346 cubic inches (5,669.92cc) to 364 cubic inches (5,964.89cc). The new engine yielded 400 horsepower, 50 more than the C5's LS1 and only 5 shy of the C5 Z06's LS6.

Though built around the same architecture as its predecessor, the LS2 used a new block, cast from 319-T5 aluminum, that was similar to the LS6 in that it featured machined openings in the main bearing bulkheads to improve bay-to-bay breathing. It also benefited from the LS6's 356-T6 aluminum alloy cylinder head castings, which offered improved airflow characteristics. By virtue of these heads, a new nylon intake manifold, and less-restrictive exhaust system, intake airflow increased by 15 percent while exhaust airflow increased by 20 percent.

In keeping with the relentless drive to lower mass, LS2 got new, thinner-wall exhaust manifolds and a smaller water pump. Revisions to the oil pan design improved oil control during aggressive driving, allowing for a reduction in oil capacity from 6.5 to 5.5 quarts. Combined, these made the LS2 15 pounds (6.80 kilograms) lighter than an LS1.

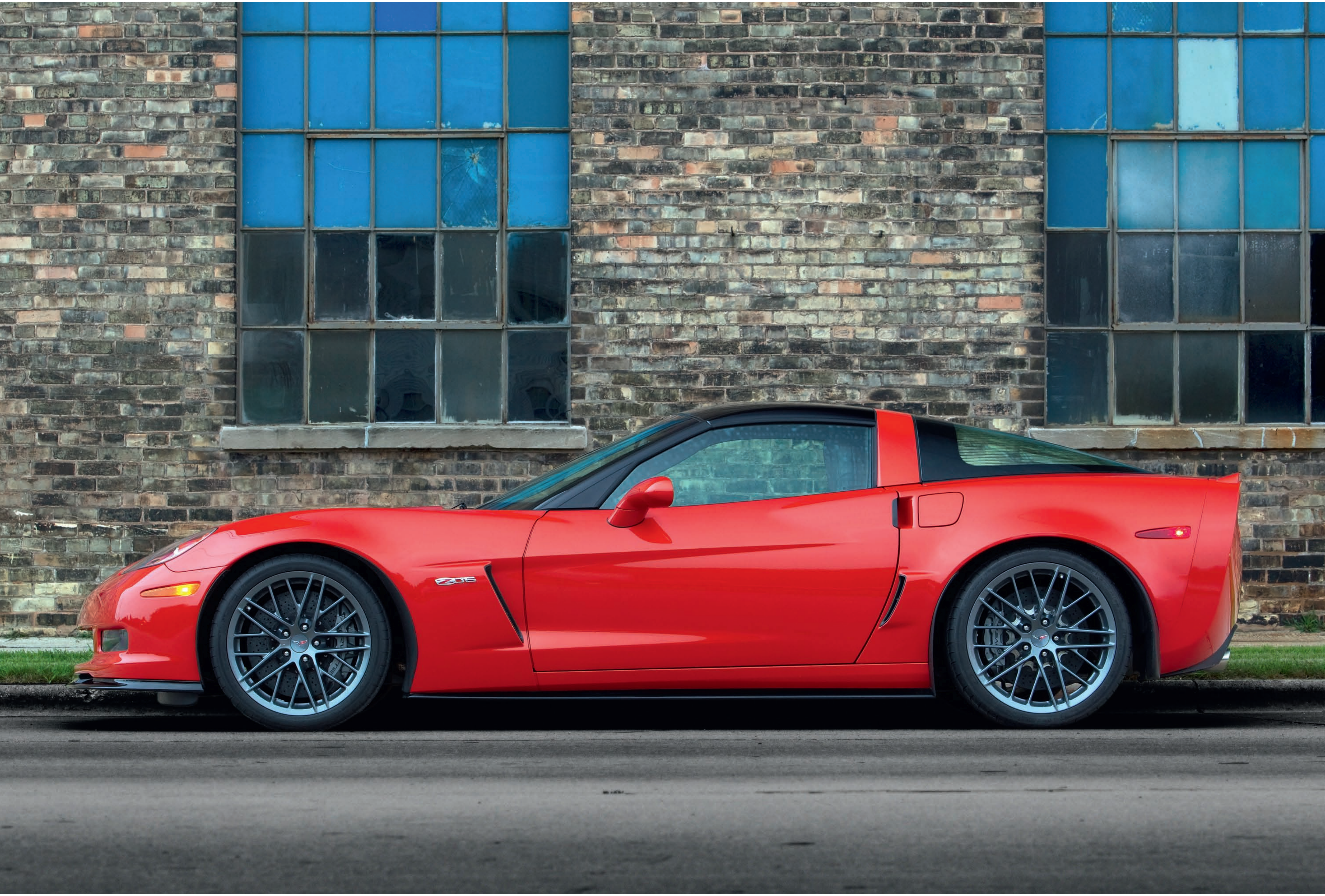
THE FINISHED CAR

The C6 brought updated styling to Corvette, firmly bringing it into the twenty-first century. It also offered more power in a lighter package. Making the C6 lighter than its predecessor was especially challenging because the new car came with several things that added weight, including larger wheels and tires, about 16 pounds (7.26 kilograms) of additional acoustic insulation, and larger brakes. Engineers dug deep to find savings and, through clever design and increased use of light alloys, including magnesium for the coupe's Targa-top frame and thin wall castings for the convertible top frame, they managed to shave about 44 pounds (19.95 kilograms) off a comparably equipped C5.

C6 did not feel like a different car in the way that C4 felt, compared with C3, or C5 felt compared with C4. For ordinary street use, drivers enjoyed a slightly more comfortable and considerably quieter ride. During spirited street driving, the new engine's extra power, shorter shifter throws, and better grip were apparent. On a racetrack with a Z51-equipped car, drivers benefited from improved handling, stability, and braking performance in addition to the engine's added power.

▲ Its long list of chassis refinements, 400-horsepower engine, and aerodynamically balanced body, refined during over 400 hours of wind tunnel testing, made the C6 Corvette exciting to drive.

◀ As with the rest of the car, C6's interior looks very similar to C5's, but the newer version benefits from better materials, increased sound insulation, greater attention to details, and added technology, including keyless access and push-button start.



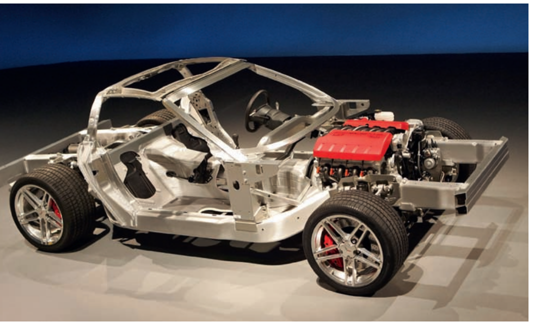
23

CONTINUOUS DEVELOPMENT

2006–2013

◀ After its introduction in 2006 the Z06 continued to evolve, and this 2011 example is fitted with the Z07 Performance Package option, which included ceramic brakes, Magnetic Ride Control, and larger Michelin Pilot Sport 2 tires on bespoke wheels.

Chevrolet produced the C6 for nine model years, and advancing technologies enabled it to deliver greater efficiency and better performance with each successive year. The first big leap in performance came with the introduction of the Z06 in 2006. A new small-block engine powering the Z06, called LS7, yielded 427 cubic inches (6,997.28cc) from its 4.0-inch (10.16-centimeter) stroke and huge 4.125-inch (10.48-centimeter) bore. Forged-aluminum pistons were linked to a forged-steel crankshaft via ultralight titanium connecting rods, which were 30 percent lighter than the steel rods used in the base LS2. Six-bolt main bearing caps secured the crank, and a dry-sump lubrication system ensured its bearings never got thirsty. The stout short block was capped with CNC-ported aluminum heads and a composite intake manifold. Each of these powerplants, hand-assembled by an individual master engine builder in GM's new Performance Build Center in Wixom, Michigan, produced 505 horsepower and 470 lb-ft (699.437 kilograms per meter) of torque.



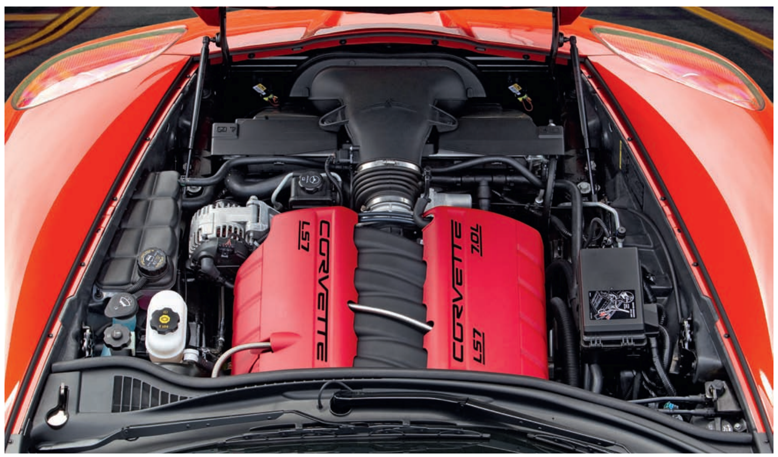
▲ The C6 Z06 was the first production Corvette with an aluminum chassis, which saved 136 pounds (61.69 kilograms) relative to the standard car's steel chassis.

The potent LS7 was mated to a revised Tremec T56 six-speed transmission, featuring stronger internal parts to survive the engine's power. Likewise, the Z06 chassis, crafted from aluminum instead of steel like the regular C6, was upgraded with stiffer springs and recalibrated Sachs shocks, a larger-diameter rear stabilizer bar, and larger Speedline wheels wearing Goodyear F1 SuperCar EMT tires, sized at 275/35ZR18 up front and 325/30ZR19 in the rear. For stopping prowess equal to its propulsive power, the Z06 got a new brake system. Up front, massive 14.0-inch (35.56-centimeter) vented and cross-drilled discs were squeezed by six-piston calipers, while at the rear 13.4-inch (34.0-centimeter) discs were fitted with four-piston calipers. Interestingly, each piston in each caliper got its own brake pad, for a total of twenty individual pads. This unusual setup aided brake cooling and reduced the potential for uneven pad wear.

The Z06's added power and strengthened components were complemented by lower overall mass in spite of some things that added weight, including its dry-sump oiling system and larger brakes, wheels, and tires. The biggest weight savings came from the Z06's aluminum chassis, which trimmed off an impressive 136 pounds (61.69 kilograms). Carbon fiber front fenders, a floor made from balsa wood sandwiched between carbon fiber sheets, cast-magnesium structures for the engine cradle and roof, and elimination of a removable roof panel took off slightly more than 60 pounds (27.21 kilograms). The use of less sound insulation for the cabin and substitution of manual seat adjustments for the otherwise standard electric system cut another 33 pounds (14.96 kilograms). All told, the Z06 tipped the scales at about 50 pounds (22.68 kilograms) less than a standard C6.

The C6 Z06 remained the highest-performing Corvette that Chevrolet ever produced until 2009, when the ZR1 was unleashed. This new supercar was created under the leadership of Tom Wallace, who took over as Corvette chief engineer and vehicle line executive for performance cars following Dave Hill's retirement on January 1, 2006. The genesis of this beast can be traced back to 2004 and an off-the-cuff question posed by GM CEO Rick Wagoner. When he saw what level of performance Chevrolet could deliver in the new Z06 for about $60,000, he wondered what the Corvette team could do with a vehicle priced at about $100,000.

An initial flirtation with twin-turbo power ended unceremoniously when the development car was destroyed by fire. The timing was fortuitous because Eaton was just putting the finishing touches on the sixth generation of its roots-type supercharger, a much-improved model tagged the Twin Vortices Series. The innovative design featured four-lobe rotors rather than the tradition three, and the rotors had a higher helix angle of 160 degrees. The result was a smoother, quieter supercharger that produced more power from a smaller package, making it ideal for Corvette.



▶ All Z06 LS7 engines, which produced 505 horsepower at 6,200 rpm and 470 pound-feet (699.44-kilograms-per-meter) of torque at 4,800 rpm, were hand-assembled in GM's Performance Build Center in Wixom, Michigan.

▶▶ The ZR1's LS9 engine was force-fed air by an Eaton Twin Vortices Series roots-type supercharger capped with a Behr "dual brick" cast-aluminum air-to-liquid intercooler.

The ZR1's supercharger, wearing a Behr "dual brick" cast-aluminum air-to-liquid intercooler on top, fit snugly between the engine's cylinder banks. It delivered a maximum boost of 10.5 psi to the new 6.2-liter LS9 engine. Surprisingly, the engine was derived from the 2008 base Corvette's LS3 rather than the 7.0-liter LS7 found in the Z06, but the explanation makes sense. A driving force in Z06 design was to minimize weight and, to that end, the LS7's cylinder walls were made as thin as safely possible. That worked perfectly for a naturally aspirated powerplant making a bit over 500 horsepower, but it wouldn't provide the needed long-term durability required in a forced-induction mill yielding 638 horsepower and 604 lb-ft (898.85 kilograms per meter) of torque.

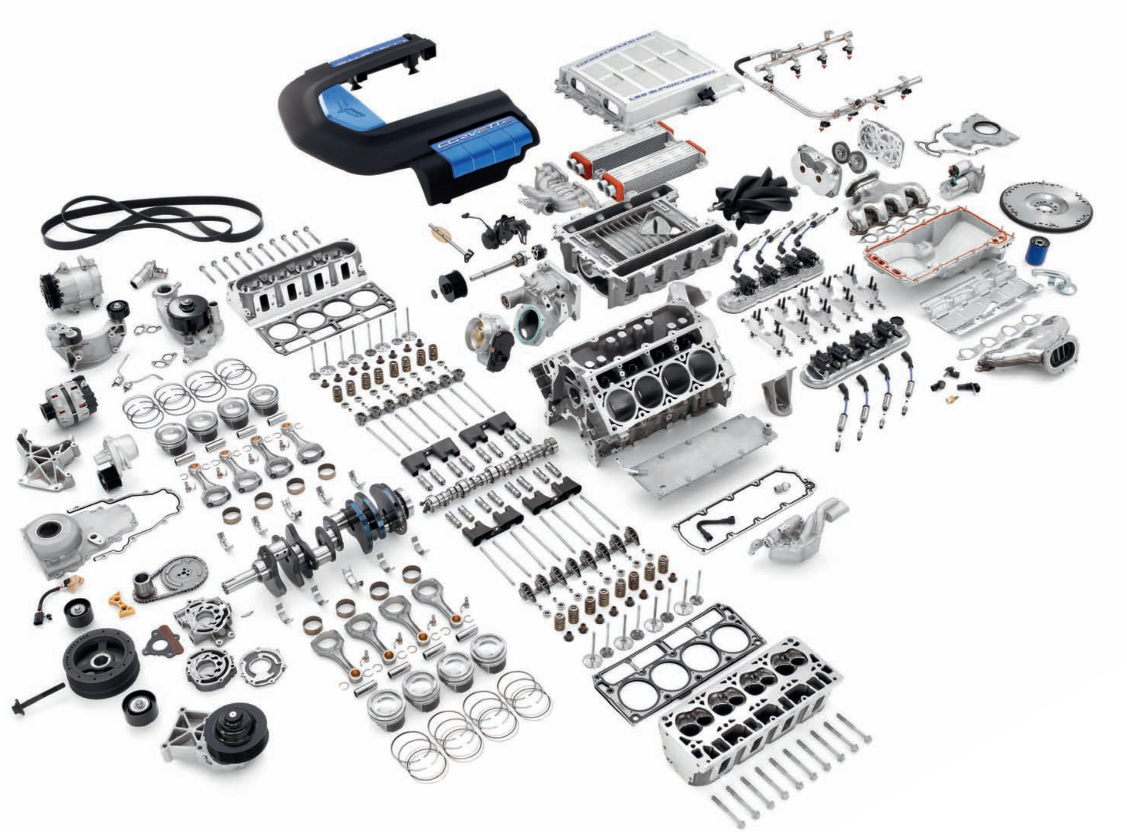
While the LS9 cylinder case was nearly identical to the LS3 case, most of the supercharged engine's other parts were either altogether new or strengthened versions of LS3 or LS7 components. For example, the LS9 cylinder heads were the same design as those used in the LS3, but they were spun-cast from a more heat-resistant aluminum alloy called A356-T6. Valve size was also the same but differed for the LS9 in that the intake valves were made from titanium while exhaust valves were sodium-filled steel, another measure intended to stand up to higher heat.

Like the Z06's LS7, the LS9 used a dry-sump oiling system, but it was modified with a higher-capacity pump to ensure adequate lubrication at the higher cornering loads the ZR1 was capable of achieving. An integrated oil cooler was mounted to the oil pan and piston-cooling oil squirters located in the cylinder block further controlled heat.

The LS9 engine's power went to the wheels via a Tremec TR6060 manual six-speed. This was a strengthened version of the new-for-2008 transmission found in the base Corvette. Gearing for the ZR1 was also different, with a steeper first gear. A twin-disc clutch supplied by LuK utilized 260mm discs, giving greater clamping power than the Z06's single 290mm unit without increasing the pedal effort needed.

ZR1 ride quality was analogous to the base Corvette, thanks in large part to the second-generation Delphi Magnetic Selective Ride Control (MSRC), which was standard in every ZR1. Tuned specifically for the new car, this real-time damping system replaced conventional mechanical-valve shocks with electronically controlled shocks filled with a synthetic fluid containing minute iron particles. When an electrically induced magnetic charge was present, the iron particles aligned to provide increased damping resistance instantly. More current yielded more magnetic charge and greater resistance in the dampers, while less current did the opposite. MSRC read the roadway an amazing thousand times per second and reacted accordingly, increasing or decreasing current to each of the four dampers to raise or lower damping resistance.

Handling prowess was further advanced by several other factors, including larger stabilizer bars, revised rear suspension geometry, and new tires and wheels. The ZR1's Speedline forged-alloy wheels, sized at 20x12 inches (50.8x30.48 centimeters) in the rear and 19x10 inches (48.26x25.4 centimeters) up front, wore Michelin Pilot Sport 2 tires measuring P285/30ZR19 in front and P335/25ZR20 in the rear. This was the



▲ The LS9 used revised LS3 block and head castings, strengthened LS7 and LS3 internal components, and a host of bespoke parts needed to stand up to the engine's prodigious power output.

▶ The C6 ZR1 featured a 638 horsepower, 6.2-liter supercharged V-8, carbon body panels, and carbon-ceramic brakes, and could sprint from 0 to 60 miles per hour (0 to 100 kilometers per hour) in 3.4 seconds, obliterate the quarter mile (0.402 kilometer) in 11.2 seconds, and reach 205 miles per hour (329.92 kilometers per hour).

▼ The Grand Sport model, introduced in 2010, replaced the Z51 option and included revised transmission gears and a transmission cooler, larger anti-sway bars, stiffer springs and shocks, rear spoiler, brake-cooling ducts, larger Z06 brakes, wider bodywork, wider wheels and tires, and other enhancements.

first Corvette to ever leave the factory with Michelins, and the first since model year 1977 to use tires not made by Goodyear.

A new Brembo braking system rounded out ZR1 performance. Extremely strong six-piston front calipers squeezed vented and cross-drilled carbon-ceramic rotors measuring 15.5 inches (39.37 centimeters) in diameter and 1.6 inches (4.06 centimeters) thick. At the rear, four-piston calipers clamped down on carbon-ceramic discs sized at 15.0 inches (38.1 centimeters) around and 1.4 inches (3.56 centimeters) across. The carbon-fiber-reinforced ceramic silicon carbide material used to craft the rotors offered an unmatched combination of low mass, incredible strength, and exceptional resistance to both wear and heat.

Several external features distinguished the ZR1. The roof and its halo, as well as the front splitter and rocker panel extensions, were clear-coated carbon fiber. A new ingredient added to the clear overcame the usual problem of UV radiation attacking carbon fiber. This magic additive cost a lusty $60,000 per gallon!

Though not as obvious because of the paint that covered them, the ZR1's fenders and hood were also made from carbon fiber. A short spoiler stretched across the deck lid, front fenders featuring twin horizontal air vents, and a polycarbonate plastic window in the hood's higher-than-usual power bulge right above the supercharger's intercoolers further distinguished the ZR1. The objective was to do what was feasible to offset the 200 or so extra pounds the supercharger and related components added to the front of the car. Even so, the ZR1 weighed 3,250 pounds (1,474.17 kilograms), about 150 pounds (68.04 kilograms) more than a Z06.

Even with that added mass, ZR1 performance was astounding. It would pull more than 1 g of lateral acceleration, brake from 60 miles per hour (96.56 kilometers per hour) to zero in 96 feet (29.26 meters), sprint from 0 to 60 miles per hour (0 to 100 kilometers per hour) in 3.3 seconds, turn the standing quarter mile in 11.2 seconds at 130 miles per hour (209.21 kilometers per hour), and reach a top speed of 205 miles per hour (329.91 kilometers per hour). This was performance at a level few cars on the planet could equal, and those that were in the same league, including Ferrari's 599GTB Fiorano, Porsche's GT2, and Lamborghini's Murcielago, cost at least twice as much as a ZR1.

In 2010 a fourth model, called Grand Sport (GS), was added to the C6 lineup. This new offering replaced the Z51 package and bridged the gap between the base car and Z06. It included the base car's 430-horsepower LS3 but was distinguished by wider front and rear fenders, Z06-style front splitter and taller rear spoiler, functional brake ducts, bespoke 18-inch (45.72-centimeter) front and 19-inch (48.26-centimeter) rear wheels, Z06 brakes, and more aggressive manual transmission gear ratios.

While the Grand Sport's performance wasn't equal to that of the Z06, it did offer some things the faster Corvette didn't have, including availability as a convertible, a removable roof panel for coupes, and a paddle-shift six-speed automatic transmission. The GS also cost considerably less than a Z06—in 2010 it stickered for $54,770 while the Z06 started at $74,285.

◀ In 2009 the GT1 Championship Edition package, celebrating Corvette Racing's success in the GT1 class as it transitioned to GT2, was available in either yellow or black for any model Corvette.

▼ Chevrolet produced a plethora of special C6 Corvettes. Top row, from left: 2006 Indy 500 Pace Car, 2006 Daytona 500 Pace Car, and 2007 Indy 500 Pace Car. Middle row, from left: 2007 Ron Fellows Championship Edition, 2008 Indy 500 Pace Cars, and 2011 Z06 Carbon Limited Edition. Bottom row, from left: 2012 Indy 500 Pace Car, 2012 Centennial Edition, and 2013 427 60th Anniversary Convertible.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THE GROWING IMPORTANCE OF RACING

2005–2013

The C5.R's impressive record of success, which included overall victory at Daytona, three one-two class finishes at Le Mans, three class wins at Sebring, and four consecutive ALMS team and manufacturer championships, helped ensure that Chevrolet's factory road race program would continue during the C6 era.

◀ Superior pit work by the Corvette Racing crew has always been decisive in the program's success, and Sebring in 2007 was no exception, with the No. 4 car winning GT1.

▲ Right out of the gate in 2005, Corvette Racing hit a high note with the C6.R at Le Mans, finishing first and second.

▶ As Pratt & Miller Engineering built new Corvette racers, Chevrolet sold most of the older ones to privateers, including the No. 72 Luc Alphand Adventures C5.R, which finished third in GT1 at Le Mans in 2006.

While the C5.R race cars were engineered and built after the C5 design was finalized, the C6.R was, to some extent, engineered in conjunction with its road-going counterpart. This benefited both, leading to a more efficient race car with a broader range of adjustments and street cars with improved aerodynamics and better reliability. The symbiotic relationship between the C6 and C6.R was also furthered by FIA homologation rules, which required cars in the new-for-2005 GT1 class to use more of the street car's chassis and structure.

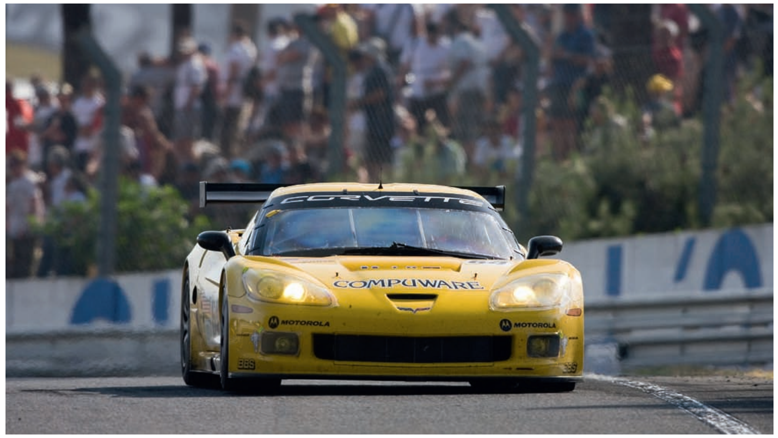
The race program got off to an auspicious start with its new C6.R, finishing first and second in the 2005 24 Hours of Le Mans and winning nine of that year's ten ALMS races, easily sweeping the team, driver, and manufacturer championships. The team would go on to win Le Mans again in 2006, 2009, and 2011, and by the conclusion of the C6.R's tenure, it had won fifty-one of the eighty-eight ALMS races contested, sweeping the championships in six out of nine years.

While Corvette Racing remained a constant presence in the top-level production GT class since 1999, other nameplates came and went, including Ferrari, Aston Martin, Saleen, Maserati, and Viper. Ironically, the team's crushing dominance was one reason other manufacturers gave up trying, and in 2007 Corvette Racing faced only a trio of privateers: Doran Racing's Maserati MC12, Team Modena's Aston DBR9, and Pacific Coast Motorsport's C6.R. The results were predictable, with the factory Corvette team winning every ALMS race. It got even worse in 2008, with only the Bell Motorsports DBR9 running in GT1. For two years, the factory Corvettes were essentially competing against each other to determine which C6.R would win. From GM's point of view, this was unsustainable, and the solution was to switch from the dying GT1 class to the growing GT2 ranks. GT2 cars were closer to their production counterparts, so they were less expensive to develop, build, and run, the primary reason the class was strong.

Corvette Racing continued running its GT1 cars for the first half of 2009, concluding with victory at Le Mans to finish on a high note. After Le Mans they ran the year's remaining ALMS races with new GT2 cars, which were designed around the C6 ZR1 road car, instead of the Z06 as before. While the GT1 racers were built with the base car's steel underpinnings, the new GT2 Corvettes were built on the production ZR1's aluminum uniframe.

Though the Corvette race cars were able to retain their Roger Allen–designed engines after changing classes, ALMS required that they be reduced from 7.0 to 6.0 liters as part of the series' effort to slow the Corvettes down to GT2 speeds. This was just an interim solution: new engines, built around LS9 components but downsized from 6.2 to 5.5 liters, went into the cars for the 2010 season. Concurrent with this change, at the conclusion of the 2009 season responsibility for the race program's engines went from Katech, the outside vendor that had been with the Corvette program since its beginning, to GM's own race engine facility in Wixom, Michigan, which was part of GM Racing Powertrain and Advanced Projects, under the leadership of Russ O'Blenes.

Corvette Racing closed out the C6.R era in 2013 by sweeping the ALMS team, manufacturer, and driver championships on the strength of five wins and three additional podium finishes in the season's nine races. It was a fitting conclusion to a highly successful period in the program's history, when the race cars increasingly benefited the performance of the production cars, and when the race program delivered a significant return on investment in terms of Chevrolet brand loyalty and vehicle sales. This is demonstrated by the fact that top management's support for the program remained intact from 2008 to 2010, when GM's bankruptcy reorganization and a global financial crisis wreaked havoc on the automobile industry in general, and on GM in particular.



▲ At Le Mans in 2006, the No. 64 Corvette C6.R of Oliver Gavin, Olivier Beretta, and Jan Magnussen won the GT1 class and finished fourth overall, ahead of twenty-one LMP1 and LMP2 prototypes, which was a remarkable accomplishment for a production-based GT car.

◀ At Sebring in 2007, the No. 3 Corvette competed in Arctic White with red fender stripes to celebrate the identically colored 2007 Ron Fellows Championship Edition Z06 production Corvette.

▼ At Road Atlanta's Petit Le Mans in 2007, the GT1 class-winning No. 4 C6.R goes through turn three ahead of Doran Racing's Maserati MC12, a rare car built on the Enzo Ferrari chassis that competed successfully in the FIA GT Championship.

▶ At Laguna Seca in 2007, the C6.Rs wore one-off graphics celebrating the team's unorthodox skull logo, named Jake.

▼ After switching to GT2 in mid-2009, Corvette Racing faced steep competition from Porsche, Ferrari, BMW, Jaguar, and Ford, but managed to win its first race in 2010 when the No. 4 C6.R of Oliver Gavin, Jan Magnussen, and Emmanuel Collard took the checkered flag first at Petit Le Mans.

▼ At Le Mans in 2011 Corvette Racing earned its seventh class win there. President of General Motors Mark Reuss, Corvette Racing Program Manager Doug Fehan, and Vice President of General Motors Performance and Motorsports Jim Campbell, *left to right in the rear,* join C6.R drivers Tommy Milner, Olivier Beretta, and Antonio Garcia *left to right* on the podium.

▶ Antonio Garcia and Jan Magnussen earned the C6.R's final victory at Circuit of the Americas in Austin, Texas, on September 21, 2013.

◀ By 2011 Corvette Racing was a mature and highly cohesive team at the top of its game, with an all-star driver lineup and crew that was second to none.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GG C 7004

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FORWARD MOMENTUM

C7 INTRODUCTION, 2014

Chevrolet revived the name Stingray for the seventh-generation Corvette, which was introduced as a 2014 model. While its proportions and general chassis layout were similar to those of C6, it was dramatically changed and improved in every measure. Those creating the C7 knew this would likely be the final iteration of a front-engine Corvette, and they were determined to optimize every aspect of the car's performance and appearance.

◀ Whether coupe or convertible, which were introduced simultaneously in 2014, form followed function to arrive at C7's beautiful, highly aggressive, and precisely balanced styling.

▲ The 2009 Corvette Stingray Concept, shown with the designers who created it, was one of five Chevrolet-based characters in the film *Transformers: Revenge of the Fallen*. Though purely an exercise to integrate classic Corvette styling cues into a futuristic design and not destined for production, this car did influence the look of C7.

ENGINEERING THE C7 STRUCTURE

Though the general layout of the C7 didn't change, its chassis was dramatically improved, largely by virtue of the increasingly powerful computer tools and advances in metallurgy and materials that were available. The engineering team, led by group manager for structure Ed Moss, used Genesis Structural Analysis and Optimization Software to create a new, all-aluminum chassis that was almost 100 pounds (45.35 kilograms) lighter than a steel C6 chassis and about 60 percent more structurally rigid than either the steel or aluminum C6 structure. This was needed to meet the ambitious C7 goal of using the same aluminum chassis for a Targa-top coupe and a convertible without having to add any structural elements to account for the absence of a roof.

The incredibly sophisticated Genesis design software quickly got the engineers much closer to optimum solutions that minimized weight and maximized strength than they could have reached without it. Additional analysis and dynamic testing techniques allowed them to further refine the design. But even the best-engineered chassis is useless if it can't be built in a timely, cost-effective manner, and this is where advances in metallurgy, materials science, and manufacturing methods came into play. For example, by specifying 7000 series aluminum, which uses zinc as a primary alloying element, augmented by magnesium and copper, to manufacture extremely strong extrusions for the front of the chassis, they were able to reduce mass without sacrificing any of the strength needed to absorb significant amounts of energy in a frontal collision. Similarly, octagonal sections of aluminum were joined to form a figure-eight structure with high strength and excellent energy-absorbing qualities.

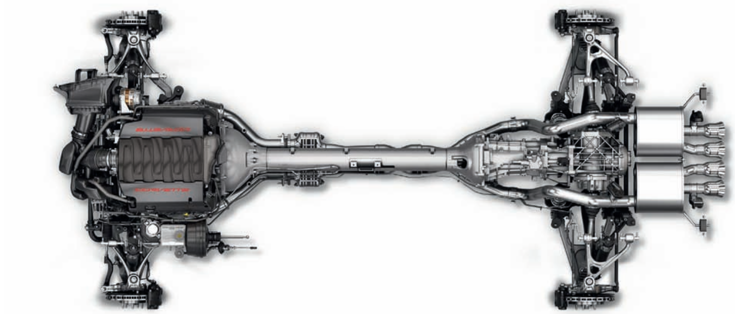
It wasn't just the advanced alloys and clever shapes that gave the C7 structure its high strength-to-weight ratio. The new computer design tools and manufacturing techniques employed enabled engineers to vary the thickness of extrusions, stampings, and castings as needed, allowing for the use of thinner, and thus lower-mass, materials where warranted. In fact, a total of sixteen different thicknesses, ranging from about 1.8mm up to about 11mm, were employed.

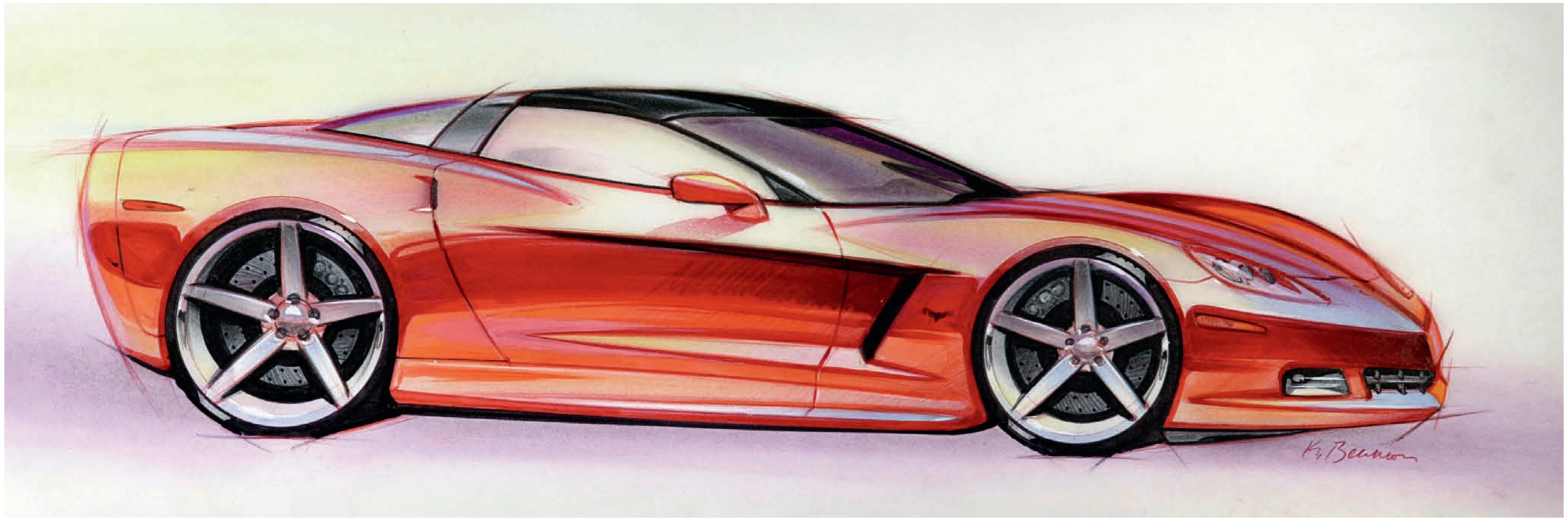
Joining together parts varying in thickness and produced from different aluminum alloys is challenging, so engineers had to develop some innovative new techniques to manufacture the C7 chassis. Among these were extremely precise welding methods, lightweight mechanical fasteners, and advanced structural adhesives.

STYLING THE C7 BODY

Design of C7 got underway in 2007 but was shelved because of GM's financial problems, which ultimately led to a bankruptcy filing on June 1, 2009. To the surprise of some, and the delight of many, Corvette survived the reorganization and downsizing of GM, and after the company emerged from bankruptcy, Global Vice President for Design Ed Welburn requested C7 proposals from every GM design studio around the world.

More than three hundred sketches were submitted, all reviewed by a team headed up by Kirk Bennion, lead C7 exterior designer. Bennion, who worked for Director of Exterior Design for GM Performance Cars and Full-Size Trucks Tom Peters, had also managed exterior design for the C6. According to Bennion, a primary challenge in designing C7 was creating a Corvette that retained its uniquely American personality while simultaneously appealing to a broader range of international consumers.





◀◀ The C7's aluminum chassis, with its ten castings, thirty-eight extrusions, seventy-six stampings, and three hydroformed parts, weighs only 378 pounds (171.46 kilograms) and is almost 60 percent more rigid than the C6 structure, enabling Chevrolet to use the same chassis for both a Targa-top coupe and a convertible.

◀ The C7's central backbone torque tube linking the engine to the transmission and axle assembly provides high structural integrity and helps enable optimum front/rear weight distribution.

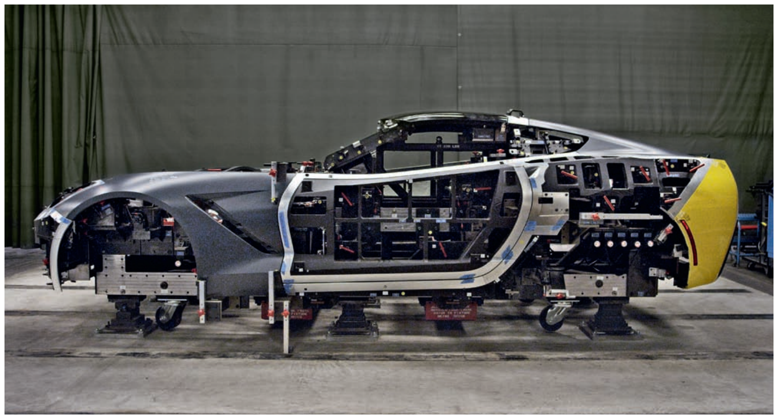
▼ Aside from its lower roof line, taller wheels, and a few details, this sketch by C7 exterior design manager Kirk Bennion is close to final C7 appearance.

▼▼ Various scale models and drawings of early C7 design proposals.

▲ Sculptors put the finishing touches on a full-size C7 clay and start to wrap it with 3M DI-NOC PVC film.

▶ This dimensional fixture helped ensure that C7 body panels would properly fit on the underlying structure.

▼ Full-size C7 study in clay, on display in the Design Center courtyard in 2010, exhibits the basic lines that ultimately went into production.



While the basic layout for C7 would remain unchanged from its predecessors, it was determined early on that the new car would have a longer wheelbase and wider track. The engine would move slightly rearward and increased cooling demands, as well as relocation of drivetrain coolers from the front to the rear, were also engineering dictates that the designers had to respect. And, as always, improving aerodynamic performance, which directly impacts not only stability throughout Corvette's speed range, but equally important, its fuel consumption, was also a mandate. Within those parameters, stylists worked to create a noticeably bolder and far more aggressive design but, crucially, one that was still unmistakably a Corvette.

The three-hundred-plus design sketches submitted initially were pared down, with those showing promise undergoing further development by their creators. Additional reviews culled the herd more, and the several dozen survivors were brought to the next phase of the process as three-dimensional scale models. These went through several stages of review and analysis, and two went on to full-scale clay models.

Though the painstaking process of going from several hundred sketches to a handful of meticulously finished full-size clay models was led by Bennion and his boss, Tom Peters, many others played a strong role. Notable among them were Ed Welburn and Mark Reuss, who was promoted from vice president of engineering to president of GM's North American operations in 2009.

When the intensely competitive process of choosing what direction to go in was over, the work of designer Hwasup Lee emerged triumphant. Lee started working for GM in 2000, fresh out of Pasadena's Art Center College of Design, and later joined Tom Peter's Performance Vehicle Studio in 2008. From the beginning, Lee was focused on creating a distinctly new design that was still instantly recognizable as a Corvette. He looked far and wide for inspiration, ranging from modern fighter planes and contemporary architecture to iconic Corvettes from the past, including the 1957 *Corvette SS* and 1969 *Manta Ray*.

◀ Aerodynamic performance was more important than ever for those designing C7 to improve stability, reduce fuel consumption, and meet increased cooling requirements.

The decision to move forward with Lee's design was reached in the summer of 2010, but the work was far from over. The entire Corvette design team continued refining Lee's vision, finding ways to preserve its integrity while improving its aerodynamic efficiency and overall functionality.

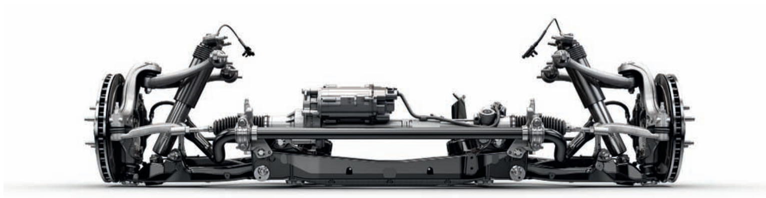
STYLING THE C7 INTERIOR

First- and second-generation Corvette interiors were adequate for their eras. When it was introduced in 1968, the C3 interior was perfectly acceptable. The third-generation car endured an unprecedented fifteen model years, however, and by the end its interior was outdated in every measure, especially in its fit, finish, and materials. The Corvette team spent the next several decades struggling to catch up, but they never had sufficient budget to fully stretch their wings. That changed with C7.

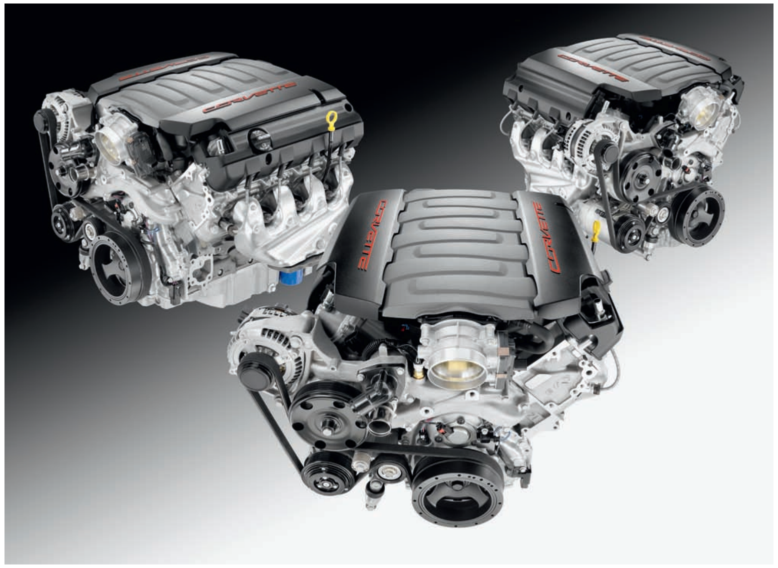
Just as C6 production was beginning, GM's senior leadership committed to invest heavily in upgrading the interiors of all vehicles, including any future Corvettes. In the summer of 2009, just as he'd done for the C7 exterior, Ed Welburn invited every designer in every GM Design studio around the world to submit sketches representing their vision for the new interior. Helen Emsley, director of GM's Performance Car Interior Design Studio, managed the process, and near the end of the year three proposals were selected for further refinement. Those three were presented to Welburn and, after carefully reviewing them, he sent his designers back to the drawing board and challenged them to do better. After that second round of submissions was completed, the design penned by Ryan Vaughan emerged as the leader. As such, it was chosen to move forward to a three-dimensional clay mockup. In early April 2010, after seeing Vaughan's design in clay, Welburn chose it to serve as the basis for C7 production.

In translating the winning design to a complete interior ready for production, Vaughan and his colleagues faced numerous challenges. The C7 interior had to provide everything needed by a skilled driver who was pushing the car to its limits on a track, and at the same time it had to be extremely comfortable and suitable for long-distance touring and everyday transportation. It also had to be more attentive to the needs of the passenger than any previous Corvette interior had been and, for both driver and passenger, it had to convey a feeling of unmatched quality.

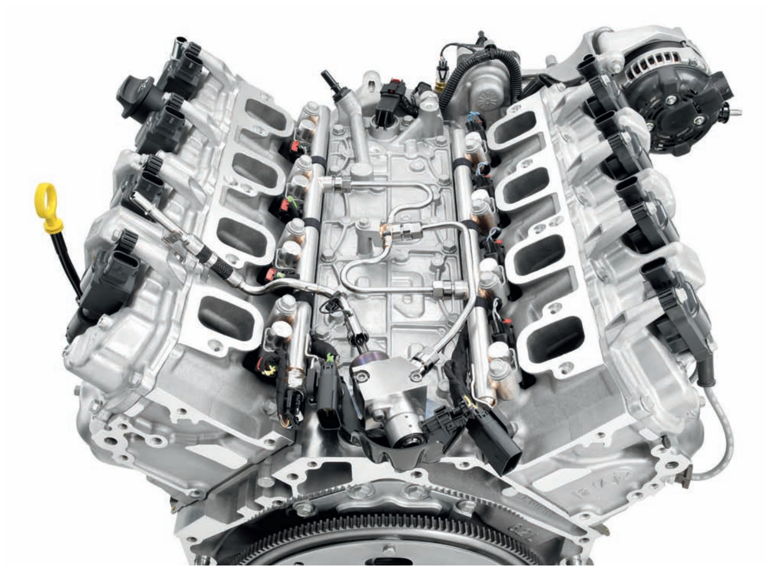
▲ Electric power steering introduced in the C7 varies the ratio and effort required depending on the car's speed, selected drive mode (sport, touring, or track), and other variables.



▶ The new fifth-generation LT1 V-8 that powered C7 was extensively redesigned, with the only parts carrying over from the previous engine being the starter motor bolts, piston pins, pin clips, valve retainers, and valve keepers.



▼ The C7's LT1 engine benefited immensely from direct injection, located in the valley between the cylinder heads. It allowed for precise control of the amount, timing, location, and spray pattern of the fuel, which improved drivability, horsepower, fuel economy, and emissions.



Perhaps the most unusual aspect of the C7 interior was its asymmetry, which broke with the twin-cockpit motif used since 1963. The side-to-side differentiation was driven primarily by functional considerations, with a bias toward the driver's needs when the car approached its limits of performance. This required reinforcing the center console to withstand the forces generated by the driver's body when cornering at 1g-plus and placing all controls within easy reach and all instrumentation within easy view. Passenger accommodations, including dual grab bars and HVAC controls beneath a vent at the far right of the dash, added to the asymmetry.

A nonnegotiable mandate from Welburn was that all materials used throughout the interior be authentic. That meant anything that looked like carbon fiber had to in fact be carbon fiber, anything that looked like aluminum really was aluminum, and any assemblies that appeared to be stitched together actually had to be stitched together. The result was a visual richness that far surpassed all previous Corvette interiors and rivaled anything offered by the world's leading luxury brands.

Beauty also lay beneath the new interior surface. Advanced computer-aided design along with lightweight materials, such as titanium for the seat frames, yielded exceptionally efficient components and systems. Exotic materials, such as Aerogel, an extremely effective and super-low-mass insulation originally developed for astronaut suits and other aerospace applications, helped make the C7 interior safer, quieter, more durable, more efficient, and more comfortable.

POWERING THE C7

Chevrolet introduced an all-new, fifth-generation V-8 called LT1 to power the C7. Its familiar 90-degree V cylinder case, 4.4-inch (11.18-centimeter) bore spacing, cam-in-block and pushrod valve actuation setup, and two-valve cylinder heads continued the small-block Chevy architecture introduced in 1955, but with the most up-to-date technology to achieve a remarkable combination of excellent fuel efficiency, low emissions, and high power.

The only parts carried over to the 6.2-liter LT1 from the fourth-generation V-8 powering C6 Corvettes were the starter motor bolts, piston pins, pin clips, valve retainers, and valve keepers. Chief among the new engine's features was its direct-injection fuel system. Unlike previously used port fuel injection, which introduced fuel into the air charge in intake manifold ports, direct-injection introduced fuel directly into the combustion chamber. The new system allowed for far more precise control of the amount, timing, location, and spray pattern of the fuel, and this yielded big improvements in drivability, horsepower, fuel economy, and exhaust emissions.

New cylinder heads made from 319-T7 aluminum alloy were assembled with titanium valves positioned to reduce shrouding and enhance airflow. The heads featured large rectangular intake ports shaped to optimize airflow and 59.02cc combustion chambers. In concert with carefully shaped forged-aluminum pistons, the relatively small combustion chambers yielded an 11.5:1 compression ratio. This high compression, which advances all areas of engine performance, was only possible with the piston and combustion chamber cooling offered by direct injection.

Better fuel economy, without sacrificing any power, was achieved with Active Fuel Management (AFM), a system that temporarily deactivated four of the engine's eight cylinders when they were not needed. AFM used two-stage hydraulic roller lifters to deactivate and reactivate cylinders, all in the span of only 20 milliseconds.

Complementing AFM was a new variable-valve timing system called Dual Equal Cam Phasing. A hydraulic vane-type phaser positioned at the front of the camshaft altered the timing of valve actuation almost instantaneously, allowing the engine to optimize fuel consumption and minimize emissions when feasible, and to maximize power output when needed. While delivering the best fuel economy of any Corvette to date, the LT1 also produced the highest output of any base powerplant—460 horsepower and 465 lb-ft (691.99 kilograms per meter) of torque.

▲ After evaluating C7 interior designs from GM studios around the world, Ed Welburn chose to go forward with Ryan Vaughan's proposal. This was ultimately refined and executed for production using the finest materials and techniques ever seen in a Corvette up to that point.

THE FINISHED CAR

The C7's sharper, more aggressive styling gave it a thoroughly contemporary look while its long, low hood, arched fenders, side coves, and raked posture combined to make it unmistakably a Corvette. As intended, GM's company-wide commitment to seriously upgrade interiors made the C7 cockpit equal to or better than competitors' sports cars costing far more than a Corvette.

In terms of performance, C7 raised the bar in every way. By virtue of advanced design and sophisticated computer controls for both chassis and drivetrain, its potent 6.2-liter LT1 engine and seven-speed manual or six-speed automatic transmission delivered 0–60 times under 4.0 seconds and low 12.0-second quarter miles alongside fuel economy of 17 miles per gallon (7.23 kilometers per liter) in the city and 29 miles per gallon (12.3292 kilometers per liter) on the highway.

C7's virtues did not go unnoticed in the marketplace. Chevrolet sold a total of 189,507 C7 Corvettes over their six-year lifespan, bettering the per-year average sales of C6, C5, and C4. Those strong sales and the healthy profits they delivered led to significant yearly improvements for C7 and encouraged GM management to invest heavily in the next-generation Corvette.

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OPTIMIZATION

2014–2019

When introduced in 2014, the base C7 delivered performance on par with the previous generation's track-focused Z06. This was a clear omen that higher-output renditions of the new C7 would set new performance benchmarks, and the C7 Z06 did exactly that.

◀ With the Z06, ducts ingest air at the corners of the grille and direct it to the front brakes while scoops in front of the rear wheel openings do the same for the rear brakes.

▶ The C7 Z06 included upgrades to the body, engine, drivetrain, suspension, brakes, wheels, tires, electronics, and cooling system to make it more capable on a road course.

The heart of the Z06 was a 650-horsepower, 6.2-liter, supercharged V-8 called LT4. John Rydzewski, Chevrolet's assistant chief engineer for small blocks, explains how they ended up with a supercharged engine. "We were looking for a higher output engine to meet the objectives for what Tadge Juechter wanted in the Z06, which was the performance of a ZR1 with an engine that's as compact and efficient as possible. We looked at several different options for how to do this, from a naturally aspirated, large-displacement spinner engine to various methods of boost, and we determined that the best solution is a compact supercharger design on the existing LT1. This was the most elegant solution because it was least disruptive to the existing vehicle."

But in order to minimize changes to the existing vehicle, they needed a supercharger compact enough to fit under the standard hood, yet potent enough to reach the engine's power targets. Such a supercharger didn't exist, so they worked with supplier Eaton to create one. The newly designed R1740 TVS was 10mm shorter and 10mm smaller in diameter than the LS9 supercharger, obviating the need for a hood bulge. Though design changes such as different rotor spacing and higher speed—it spins up to 20,000 rpm, 5,000 more than the supercharger on the LS9—yielded greater efficiency, the smaller supercharger did squeeze less air than the larger unit used on the LS9, 1.74 liters of air per revolution instead of 2.3 liters. Emblematic of how Chevy's engineers tackled tough problems throughout the new car, Rydzewski's team stretched their thinking to find clever ways to cheat the laws of physics and extract more power out of a smaller package.

"We needed to minimize all of our losses to meet our power objectives with less boost," explains Rydzewski. "We worked a lot on the airflow path coming into the engine, with CFD (computational fluid dynamics), with a lot of iterations, and we came up with a very efficient flow path going into the supercharger. We also developed an improved discharge port that minimizes turbulence, reducing heat and speeding up airflow through a more efficient intercooler and into the engine."

While the LT4 employed the same cylinder case as the LT1, it used several new parts to handle higher cylinder pressures and added power output. These included titanium intake valves, stainless-steel cast exhaust manifolds, a modified cam, and improved pistons.

The LT4 cylinder head design was essentially the same as the LT1 heads, but the LT4 units were more robust. They were rotocast from A356T6 aluminum alloy and this yielded castings that were stronger and better able to withstand high heat. Heat management was also aided by a larger-capacity oil cooler for the otherwise standard Z51 dry-sump oiling system.

While all prior versions of Z06 were available only with manual gearboxes, Chevrolet decided to offer the C7 Z06 with an automatic transmission. The existing six-speed automatic was not strong enough, though, so Juechter challenged engineer Bill Goodrich and his colleagues in the transmission engineering group at GM Powertrain to meet extraordinarily difficult objectives for the new transmission. Compared with the six-speed automatic it was to replace, the new eight-speed unit had to be lighter *and* strong enough to withstand the supercharged engine's enormous torque production, not larger (and preferably smaller), and better performing in all measures. And it had to do all of this at approximately the same cost as the six-speed.

GM has been a leading pioneer in automatic transmission design going back to Hydra-Matic Division in the 1930s and Goodrich's tight-knit engineering group drew on the company's decades of deep experience as well as today's most advanced computer tools to solve the complex problems they faced. "We started with a clean sheet of paper," Goodrich explained,

> **Looking at various power flow combinations and options, and what was best for fuel economy, what was best for the speed and torque, and how we could achieve packaging size that the Z06 required. Meeting those three goals while also doing it efficiently for fuel economy was our greatest challenge. In trying to package and arrange the components, we made extensive use of finite element analysis throughout the development process to optimize for mass. Mass is obviously a key characteristic when you're talking about a performance car like the Z06. We've made extensive use of aluminum and we have a few magnesium parts inside the transmission. We actually have an aluminum gear set and carrier, which is a first for GM.**

◀ A compact Eaton R1740 TVS supercharger enabled the LT4 to produce more power than the C6 ZR1's LS9 engine.

Besides using lighter materials, Goodrich's team did a lot of mass optimization, putting what they called "metal savers" wherever they could. This meant removing material and thus saving mass wherever it could be done without compromising safety and durability by drilling, machining, or modifying molds and tooling.

They also reduced mass through intelligent design, rethinking age-old functionality for the automatic. "In the torque converter area," explained Goodrich, "we've gone to an optimized drive plate as opposed to specific lugs that have been typical in the past. We have a new oil pump that we've moved from the centerline axis of the transmission down into the valve body in the bottom pan, which helped reduce the size, the spin loss, and the mass. Those are just examples of things we've put in place to try to get the mass down. Getting sprung mass out helps the overall performance of the car so we want to be as light as possible."

In addition to the new eight-speed automatic, which was manufactured in GM's Toledo Transmission plant, the new Z06 was also available with a seven-speed manual gearbox. As with the base Stingray, manual transmission Z06s came equipped with Chevrolet's Active Rev Matching system.

▶ Prior-generation Z06 Corvettes, going back to 1963, were available as fixed-roof coupes only, but the extraordinary stiffness of the seventh-generation's aluminum chassis allowed Chevrolet to offer buyers their choice of a C7 Z06 convertible or coupe.

Virtually all Z06 exterior design changes, including its wider stance, were driven by functional considerations. The base Z06 came with Michelin Pilot Super Sports while those fitted with the Z07 package got Michelin Sport Cup 2 tires. Either way, they were sized at P285/30ZR19 up front and P335/25ZR20 at the rear. Z06 got its own lightweight, spin-cast aluminum wheels measuring 19x10 inches (48.26x25.4 centimeters) in front and 20x12 inches (50.8x30.48 centimeters) in the rear.

As a track-oriented car, added cooling capacity for the engine, transmission, differential, and brakes were another important consideration in the car's exterior design. Compared with the base Stingray, Z06 got very large front fender vents to exhaust more air from the engine compartment and unique air blades over the inlets on top of the rear quarters to channel about 50 percent more air into the transmission and differential cooling ducts. The wider Z06 rear fascia had larger exhaust ports adjacent to the taillamps to help move the added air volume out. Ducts that took in air at the corners of the grille cooled the front brakes, while scoops in front of the rear wheel openings directed air to the rear stoppers.

Perhaps the most interesting cooling feature, however, was the new front grille. According to Corvette designer Kirk Bennion, the beautifully crafted egg-crate design flowed more air than the opening would with no grille at all. "The attributes of the front grille are very unique in that if you were to pull it out of the car the airflow would actually go down. It actually enhances the airflow and that's due to its construction, and how we used minimum draft angle and how we oriented the shape."

Taking a page from the Corvette Racing program, air ingested through the grille went through a tilted radiator and the supercharger's intercooler before exiting out the louvered hood vent. By going up through the hood rather than down and underneath the car, the airflow contributed to downforce rather than lift.

"The goals for the aerodynamics on this car were much more extreme than what we've ever done before," explained Bennion. "This is an actual downforce car." In fact, GM boldly stated that the most extreme version of this new Z06 was the highest street-legal downforce car they'd ever tested.

Exactly how much downforce a Z06 produces depends on which of the three available aero packages it has. Bennion explained the rationale for offering different aero setups: "There's a diverse customer base. There are people who enjoy driving the Z06 and then there are people who *really* enjoy driving the Z06 on the track. And for those people who want to maximize the car's potential on the track, we offer the Z07 package."

In its standard state, the Z06 aero parts included spats around the front wheel openings, the aforementioned hood vent, and the same upright rear spoiler found on Stingrays with the Z51 Performance Package. The second aero stage consisted of a carbon-fiber package, available in either black or a visible carbon-fiber finish. This package included a carbon front splitter with aviation-style winglets, carbon rocker panels, and a larger, three-piece rear spoiler with fixed wicker bills. The wicker bills were small, vertical tabs at the edges of the spoiler's blow-molded center section that measurably increased downforce.

The third and most extreme aero configuration came from the optional Z07 package, which included several special aero components. At the front, owners could install either of two different-sized carbon winglets for the front splitter and at the rear there was a tall, center wicker bill that featured about 25mm of adjustment. This wicker bill was clear, so it didn't interfere with rearward vision when adjusted to its highest position.

In 2017 Chevrolet introduced another C7 performance variant, the Grand Sport. It incorporated almost all of the performance upgrades included with the Z06, except for the supercharged engine. It also included several bespoke features, including a specific Grand Sport wheel design sized at 19x10 inches (48.26x25.4 centimeters) in the front and 20x12 inches (50.8x30.48 centimeters) at the rear. Like the Z06, these wore Michelin Pilot Sport summer tires measuring 285/30ZR19 and 335/25ZR20. Also, like the Z06, Grand Sports came standard with a Brembo brake system featuring 14-inch (35.56-centimeter) rotors and six-piston calipers in front and 13.4-inch (34.03-centimeter) rotors and four-piston calipers in the rear, but it could be equipped with the optional Z07 package, which added carbon ceramic-matrix brakes and Michelin Pilot Sport 2 Cup tires.

In 2019, the final year for Chevrolet's seventh-generation Corvette, a new ZR1 was unleashed. It was a tour de force of technology and the ultimate expression of a front-engine supercar, offering performance at a level few road-going cars from any manufacturer could even approach.

All ZR1s were propelled by a supercharged 6.2-liter LT5 engine producing an astounding 755 horsepower at 6,300 rpm and 715 lb-ft (1,064.04 kilograms per meter) of torque at 4,400 rpm. Most of the additional power, compared with the LT4's output of 650 horsepower and 650 lb-ft (967.31 kilograms per meter) of torque, is the result of the LT5's Eaton TVS R2650 supercharger, which yields 14.0 psi of boost compared with the LT4's 9.4 psi. The ZR1 blower's output goes through intercoolers with about twice the heat-transfer capacity of the Z06 intercoolers, further enhancing power output. To handle the potent engine's thirst for fuel, a dual-injection system employing both direct injection and supplemental port injection was employed.

Buyers most interested in road course performance specified option ZTK, which added a two-way adjustable high rear wing capable of generating 950 pounds (430.91 kilograms) of downforce, which is 60 percent more than a 2019 Z06 fitted with the Z07 performance package. In concert with its downforce-generating front splitter, Michelin Pilot Sport Cup 2 tires, and unique chassis and Magnetic Selective Ride Control tuning, ZTK-equipped ZR1s navigate a road course faster than any prior production Corvette.

For ultimate acceleration and top speed, however, the standard low wing setup was optimum because it minimized drag. A ZR1 with the standard aerodynamic package could accelerate from 0 to 60 miles per hour (0 to 100 kilometers per hour) in about 2.85 seconds and reach a top speed of more than 212 miles per hour (341.18 kilometers per hour). Performance at this level, in a car that cost about $120,000 and was perfectly suitable for everyday use, had no equal anywhere in the world. Chevrolet produced 2,441 ZR1 coupes for retail sale and 512 ZR1 convertibles, for a modest total of only 2,953 units.

◀◀ The C7 ZR1 was available in 2019 only, and that year the Corvette assembly plant in Bowling Green turned out 2,441 coupes and 512 convertibles, for a modest total of 2,953 cars.

▼ The 755-horsepower ZR1 that paced the Indy 500 in 2018 is the fastest, most powerful car ever to pace this famous race.


CORVETTE
CHEVROLET
100 WINS
CORVETTE RACING

27

RACING THE SEVENTH GENERATION

2014–2019

Over its six-year run, the racing version of Chevrolet's seventh-generation Corvette Z06 amassed an enviable record of seventeen victories in seventy-three events, including one at Le Mans (2015), two at Daytona (2015 and 2016), and three at Sebring (2015 to 2017). It also brought Corvette Racing three GTLM driver and team championships and two GTLM manufacturer championships.

◀ Following Corvette Racing's one-hundredth all-time win, which came with the No. 4 C7.R's victory at Lime Rock on July 23, 2016, the team assembled for a photo at the following race at Road America to celebrate this milestone.

While sharing a lot in common with their predecessors, the C7.Rs diverged in a number of important ways, starting with the frame. The C7.R was designed around the same aluminum chassis underpinning the C7 Stingray and Z06. While the C6 and C6.R used a chassis made from continuous hydroformed main side rails with a constant 2mm wall thickness, the new C7 street and race car chassis used side rails built up from five distinct aluminum segments. These included extrusions at each end, a hydroformed center section, and hollow-cast nodes at the suspension interface points. Segmenting the rail into five separate parts enabled engineers to optimize each area, tailoring the gauge, shape, and specific material properties to maximize strength and minimize mass.

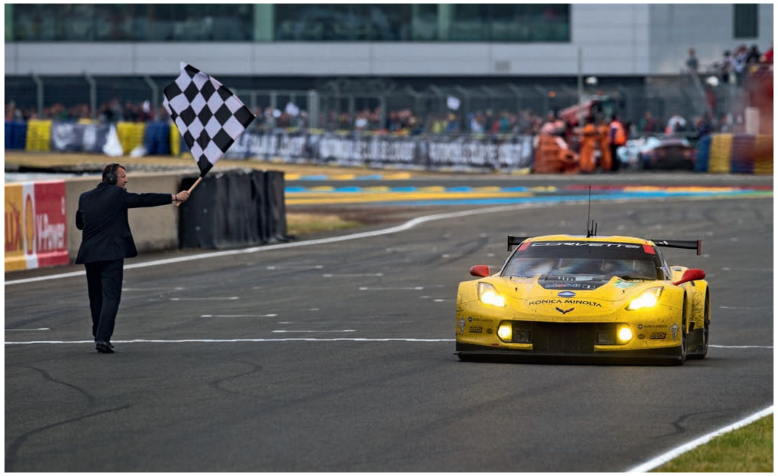
"The improved production structure, with its precise castings, extrusions, and so on, enabled us to achieve a 40 percent increase in torsional stiffness with 26 pounds (11.79 kilograms) of mass reduction in the C7.R structure," revealed PME Engineering Director Doug Louth. "The structural links between the bottom of the cradles and the bottom of the frame rails were very beneficial, and the new stressed tunnel close-out panel was also very helpful in terms of torsional stiffness."

The tunnel closeout connected the driver- and passenger-side cockpit floor sections for a more continuous shear plane on the bottom of the car. It was one of many design elements

▶ As with all of the Corvette Racing program's cars Chevrolet has raced since 1999, the C7.Rs were assembled by the fabricators and technicians at Pratt & Miller Engineering.

▶▶ GM Performance and Racing Propulsion engine technician Paul LaBroski preparing the C7.R's 5.5-liter naturally aspirated engine for dynamometer testing.

▼ On April 11, 2014, Corvette Racing earned its first win with the C7.R in Long Beach, with the No. 3 car of Jan Magnussen and Antonio Garcia leading all but one lap and taking the checkered flag 5.408 seconds ahead of the second-place BMW.



that migrated from the previous-generation Corvette race cars to the new street car, making C7 a better starting point for the C7.R, especially in light of revised rules that demanded greater fidelity in chassis structure between GTE/GTLM racers and their production counterparts.

The improved chassis was wrapped with a gorgeous race interpretation of the 2015 Z06 body, which was closer to its production counterpart than prior Corvette racers had been to theirs, but still different in some important ways. The most obvious difference was the pervasive use of carbon fiber for all of the race car's body parts, while the Z06 got a carbon roof and hood, and Continental Structural Plastics' TCA Ultra Lite SMC panels everywhere else. Compared to the new Z06, the race car's body was 3.4 inches (8.64 centimeters) wider at 80.7 inches (204.98 centimeters) and 3.3 inches (8.38 centimeters) lower at 45.3 inches (115.06 centimeters). Other noteworthy deviations included a larger front splitter and rear diffuser, and a substantial rear wing, all designed to increase the C7.R's downforce while minimizing drag.

As with prior-generation racers, the C7.Rs relied on a modified production-based engine for propulsive force, but the new-generation car got an important upgrade. With the introduction of direct fuel injection on production C7 Corvettes, the race-engine gurus at GM's Wixom Powertrain Lab were able to develop a similar system for the 5.5-liter race version of the engine. Direct injection in the race car provided better throttle response and, most importantly, approximately 3 percent reduced fuel consumption.

The 5.5-liter race engine sent power to the wheels through the same Xtrac six-speed sequential gearbox and viscous-coupling limited-slip differential used in the C6.R. Many of the other race car–specific chassis hardware also carried over from the C6.R. This included the AP Racing brake system, with six-piston monobloc calipers and 14.0x1.3-inch (35.56x3.30-centimeter) steel front and rear rotors, 18x12-inch (45.72x30.48-centimeter) front and 18x13-inch (45.72x33.02-centimeter) rear BBS aluminum wheels, Michelin race rubber, and Penske Racing adjustable coil-overs.

At the end of January 2014, the C7.Rs made their race debut in the 24 Hours of Daytona. This was the first event in the then-new Tudor United SportsCar Championship, which was formed when Grand-Am acquired the American Le Mans Series. As before, Antonio Garcia and Jan Magnussen were paired in car No. 3, and Tommy Milner shared car No. 4 with Olly Gavin. Ryan Briscoe joined the No. 3–car lineup for Daytona and Robin Liddell was teamed with Milner and Gavin in No. 4 at the 24-hour classic.

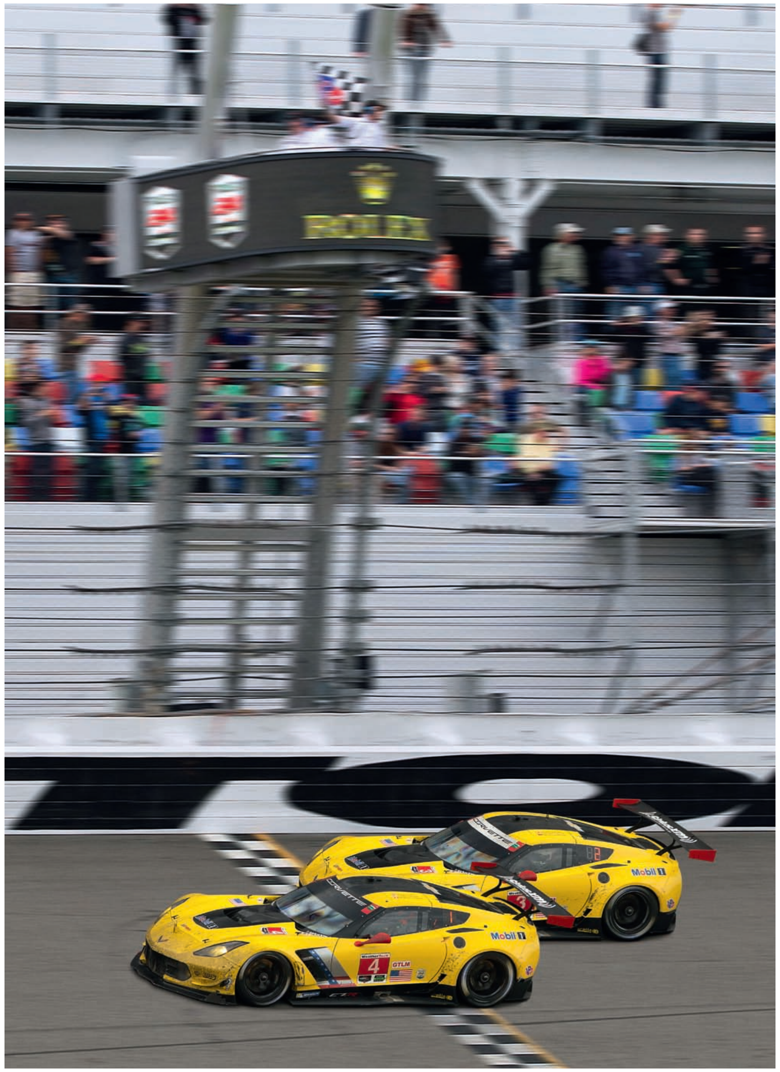
The new cars were quite fast at Daytona, with both leading at times during the race's opening hours. Trouble struck for

◀ At Le Mans in 2015, C7.R No. 63 was withdrawn following a hard crash in practice, but C7.R No. 64 went on to win, giving Corvette Racing its eighth victory at the French classic.

▲ C7.R No. 3 was driven to victory at Daytona in 2015 by Jan Magnussen, Antonio Garcia, and Ryan Briscoe, giving the whole crew reason to celebrate.

▶ In the closing twenty minutes of 2016's 24 Hours of Daytona race the two C7.Rs were nose-to-tail and side-by-side, with No. 4 ultimately taking the win by 0.034 second, the closest finish in Daytona history.

▼ At Le Mans in 2015, Jordan Taylor, Oliver Gavin, and Tommy Milner completed 337 laps for 2,864.50 miles (4,609.96 kilometers) in C7.R No. 64 and finished ahead of two Ferraris, two Porsches, and three Aston Martins to take the LMGTE Pro category win.



No. 3 near the halfway mark, however, when the engine began to run hot with Garcia behind the wheel. Over the ensuing hours, the car came into the team's garage several times in a futile effort to fix the overheating problem, but it ultimately retired after completing 329 laps.

Corvette No. 4 fared little better, placing a disappointing fifth in the GTLM class following a problem inside the car's gearbox with a little more than two hours left in the race. Milner was running second and gaining on the eventual class-winning Porsche when the gearbox temperature spiked up. He brought it into the garage, where the elevated temperature was quickly traced to a failed bearing. Thirty minutes later, Milner was back out on track with a new gearbox, but the thirteen laps lost while effecting the repair proved fatal.

The costly experience gained at Daytona paid dividends afterward with improved reliability. The team recorded a total of four wins with the C7.R in the 2014 season, at Long Beach, Laguna Seca, Watkins Glen, and Canadian Tire Motorsports Park. In 2015 they went on to win the "triple crown" of sportscar endurance racing, with victories at Daytona, Sebring, and Le Mans.

Development of the C7.R continued over time, and 2016 proved to be its most successful year. Although both cars had a poor showing at Le Mans, they were competitive in North America, with C7.R No. 4 recording four wins (Daytona, Sebring, Lime Rock, and Road America) and No. 3 taking the checkered flag at Virginia International Raceway (VIR). Gavin and Milner won the IMSA driver championship, the No. 4 car earned the team championship, and Chevrolet came away with the manufacturer title.

The 2016 Daytona race was particularly memorable because the two factory Corvettes ended up fighting each other for the GTLM win in an epic nose-to-tail battle that ensued for much of the race's final hour. When it was over, the two C7.Rs crossed the line side-by-side, with No. 4 winning by 0.034 seconds, the closest finish in Daytona history. The 2016 Lime Rock race was also one fans will long remember because the victory there was the one-hundredth for Corvette Racing. That's a milestone no other team in IMSA history has reached.

◀ The No. 64 C7.R qualified last in LMGTE Pro at Le Mans in 2015 but turned competitive lap times in the race and, unlike all of its competitors, ran flawlessly the entire twenty-four hours to take the victory.

▼ After winning the GTLM class at Daytona in 2016 by a scant 0.034-second margin over their sister C7.R, the No. 4 car crew and team managers were all smiles.

Corvette Racing went into the 2017 season as defending GTLM champions but faced an uphill battle against fierce competition from BMW, Ferrari, Ford, and Porsche. That battle was made more difficult by IMSA's balance of performance (BoP), the parameters the sanctioning body adjusts to bring individual entrants' performance up or down to keep disparate cars close on track. The 2017 BoP gave an edge to each of Corvette's adversaries, with Ford getting the most advantageous adjustments, and Ferrari and Porsche tied for a close second, BMW next, and Corvette last. Out of eleven races in 2017, Ford got pole position five times and fastest race lap three times. Ferrari was next, with two poles and three fastest race laps, and Porsche followed with two poles and two fastest race laps. BMW continued to struggle with their inherently difficult M6 cars, but still got one pole and two fastest race laps, while Corvette got only one pole and one fastest race lap.

▲ At VIR in 2017, Corvette C7.R No. 3 claimed victory over Porsche, BMW, Ford, and Ferrari, all worthy opponents who together with Corvette made IMSA GTLM class racing incredibly intense and exciting.

▶ On its way to another GTLM class victory in 2016, the No. 4 C7.R leads a Ford GT and BMW M6 through Road America's turn three, with the Corvette Corral, a tradition at Road America since 1957, in the background.

▶▶ Gary Pratt, cofounder of Pratt & Miller Engineering and Corvette Racing's team manager for many years, joined Antonio Garcia and Jan Magnussen on the top step of the podium at VIR in 2017.

When the 2017 season was over, though, Corvette's consistency, along with a fair measure of luck, overcame the bias. In addition to a dramatic victory in Sebring, the No. 3 car also won at Circuit of the Americas and VIR. On the strength of those three wins, a third place at Watkins Glen, and a runner-up finish in the season-ending Petit Le Mans at Road Atlanta, Magnussen and Garcia clinched the GTLM driver championship and Corvette No. 3 took home the team championship. The consistently strong finishes for No. 3 and the win by No. 4 at Long Beach earned Chevrolet the manufacturer championship, making 2017 the second consecutive year Corvette Racing swept the IMSA GTLM championships.

The 2018 and 2019 seasons were, in some ways, reminiscent of 2017, with Corvette fighting a disadvantageous BoP. In 2018, consistency and good luck ruled the day once again, with Magnussen and Garcia securing their second straight IMSA GTLM driver title at Petit Le Mans, the final race of the year. The No. 3 car also earned the team championship.

The results in 2019 were not nearly as satisfying, largely because the team's string of good luck had finally run out. Problems ranged from crashes—including the two Corvettes colliding with each other at Daytona and a big wreck at Watkins Glen that left Milner with a broken bone in his hand—to electrical maladies and mechanical gremlins. When it was over, Corvette had some poles and finished on the podium at numerous events, including Sebring, Long Beach, Mid-Ohio, Watkins Glen, VIR, and Laguna Seca, but for the first time since the program's inaugural season in 1999, they didn't win a single race.

Despite this dreary finish to its six-year tenure, Chevy's C7.R was, like its predecessors, an overall winning car. It carried the team to three GTLM driver and team championships, two GTLM manufacturer titles, and a victory at Le Mans.

◀ In Corvette Racing's six-year run with the C7.R, which came to a close at Road Atlanta in October 2019, the team won seventeen times, claiming three drivers' championships and two manufacturer championships for Chevrolet.


CORVETTE

28

REVOLUTION

INTRODUCING THE MID-ENGINE C8

A revolutionary all-new Corvette was introduced in 2020. Unlike every prior production Corvette dating back to the beginning in 1953, the new Stingray featured an engine located behind the passenger compartment. The roots of this radical departure, which fundamentally changed every aspect of the Corvette's appearance and performance, trace back more than six decades.

◀ A 3.2mm-thick glass window provides a good view of the engine and encourages buyers to add the optional engine appearance package, which includes carbon-fiber accents and LED lighting.

▶ The 1986 *Corvette Indy*, which is one of numerous mid-engine Corvette experimental cars built since the 1950s, was powered by a streetable version of Chevrolet's 161.71-cubic-inch (2,650cc), 32-valve, twin-turbo, DOHC IndyCar V-8 and included advanced technology for the time, such as Lotus-designed active suspension, a CRT instrument display, drive-by-wire throttle, and a satellite navigation system.

CORVETTE'S MID-ENGINE HERITAGE

Some at GM, most notably brilliant engineer Zora Duntov, passionately advocated for production of a mid-engine Corvette because of the performance benefits inherent in such a design. Chevrolet began experimenting with mid-engine layouts in the 1950s and completed the build of its first test car in 1960. Called *CERV I*, it was conceived by Duntov and designed in concert with his colleagues at Chevrolet Engineering. *CERV I*'s racing-inspired body was styled by Larry Shinoda and Tony Lapine. The car was initially powered by a Rochester fuel-injected 283-cubic-inch (4,367.54cc) engine coupled to a T-10 four-speed, and made extensive use of lightweight materials, including fiberglass for the body, thin-wall tubular chrome-molybdenum steel for the chassis, magnesium for the bell housing, and aluminum for the engine block, cylinder heads, starter motor, water pump, flywheel, and clutch pressure plate.

In 1962 the next experimental mid-engine Corvette, called *CERV II*, was constructed. Like *CERV I*, it featured advanced design concepts and made extensive use of lightweight materials, including a truss-type chassis fabricated from thin-wall steel tubing that weighed only 70 pounds (31.75 kilograms). *CERV II*'s all-aluminum 377-cubic-inch (5,522.44cc), Hilborn-injected V-8 spun all four Kelsey Hayes magnesium wheels via a pair of compact two-speed transaxles.

In 1967 the mid-engine, Corvair-based Chevrolet *Astro I* was built, and a year later Chevrolet Research and Development, under the leadership of Walter Winchell, created *Astro II*. This vehicle, which was laid out by engineer Larry Nies, featured a mid-mounted 427-cubic-inch (6,997.28cc), 390-horsepower engine coupled to a Pontiac Tempest transaxle.

At the same time *Astro II* was being constructed, work began on another mid-engine experimental car, designated *XP-882*. It began as an internal engineering study and utilized many innovative features, including a transversely mounted V-8 and transmission, fluid coupling differentials front and rear for all-wheel drive, and a welded steel platform and boxed space frame fitted with four-wheel independent suspension, rack-and-pinion steering, and disc brakes.

In 1970, one of the two *XP-882* chassis produced got a new body, designed primarily by Jerry Palmer and Henry Haga. Called *Corvette Prototype*, it was a sensation at the 1970 New York Auto Show and gave many renewed hope that Chevrolet would in fact produce a mid-engine Corvette. After returning from New York, *Corvette Prototype* got various mechanical updates, including a manual transmission coupled to a 454-cubic-inch (7,439.73cc) engine and a new body styled by Chuck Jordan and Haga. With the mechanical changes and new body, which was less angular and more curvaceous, came a new designation, *XP-895*.

In March 1972 work got underway to build a new body for *XP-895*. Creative Industries of Detroit fabricated it using 2036-T4 aluminum alloy sheets supplied by Reynolds Aluminum. As hoped, the finished *XP-895* aluminum body weighed almost 500 pounds (226.79 kilograms) less than the 1,150-pound (521.63-kilogram) steel body it replaced.

After licensing patents in November 1970 pertaining to the Wankel/NSU rotary engine from Wankel GmbH, Audi-NSU, and Curtiss-Wright, GM created two experimental mid-engine cars to showcase the unusual engine's capabilities. The first, designated *XP-897GT* and then called *Chevrolet GT*, was not initially intended to be a Corvette experimental, but in 1973 it was renamed *Corvette 2-Rotor*. The second rotary-powered car was intended to be part of Corvette's lineage from the start. Engineer Gib Hufstader created a 585-cubic-inch (9,143.98cc) four-rotor engine by joining together two RC2-195s, which were early-development two-rotor GM engines. The result was the largest automotive rotary engine ever produced, and it was installed in the other *XP-882* chassis for testing. Jerry Palmer and Henry Haga styled a new body for the car, featuring a 72-degree sloped windshield, bi-hinged gull-wing doors, and dramatically tapered and angular nose and tail. Known initially as *Corvette 4-Rotor*, this car was later converted to conventional V-8 power and renamed *Aerovette* after GM discontinued its rotary engine program.

It would be more than a decade before the next experimental mid-engine Corvette appeared. *Corvette Indy* was unveiled at the Detroit Auto Show in 1986. Its curvaceous shape, conceived by Tom Peters working under GM Design boss Chuck Jordan, was crafted with a one-piece passenger compartment canopy and carbon fiber body panels. Although the Detroit show car was a fully finished but nonfunctional mockup, a fully functional version soon appeared. Power came from a streetable version of Chevrolet's 161.71-cubic-inch (2,650cc), 32-valve, twin-turbo, DOHC IndyCar V-8. Some of the innovative technologies in this car, which included Lotus-designed active suspension, a CRT instrument display, drive-by-wire throttle, and a satellite navigation system, later found their way into production.

At the 1990 Detroit Auto Show, Chevrolet displayed *CERV III*, the most technologically advanced car of the era. Power came from a transversely mounted version of the Lotus-engineered 5.7-liter, 32-valve, DOHC LT5 engine developed for the C4 ZR-1. Fitted with twin Garret T3 turbochargers, it generated 650 horsepower and 655 lb-ft (974.75 kilograms per meter) of torque and was coupled to an experimental six-speed transaxle, created by joining a three-speed Hydra-Matic with a separate two-speed automatic. *CERV III*'s chassis featured all-wheel drive, four-wheel steering, computer-controlled active suspension, and four-wheel disc brakes using two discs at each wheel for maximum stopping power. Its wedge-shaped body, crafted from carbon fiber, Kevlar, and Nomex with aluminum reinforcements, was extremely efficient, contributing significantly the car's top speed of 225 miles per hour (362.10 kilometers per hour).

The next and, up to that point, most serious look at building a mid-engine Corvette came early in 2005, shortly after the C6 went into production. "We were in a planning meeting

▼ Knowledge gained from the GMX721 mid-engine C7 program, which got as far as the build of this beautiful full-size clay, gave Corvette's engineering and design teams a significant head start when they initiated the creation of C8. GMX721 also generated tremendous enthusiasm among GM's senior leaders, further contributing the success of C8.

▶ The experimental mid-engine 1990 *CERV III* was powered by a twin-turbo LT5 engine coupled to an experimental six-speed transaxle, and featured all-wheel drive, four-wheel steering, computer-controlled active suspension, and composite body panels.

for the next generation car," recounts Chevrolet Corvette & Camaro Product Marketing Manager Harlan Charles, "putting together our wish list. Others were thinking very conservatively, suggesting ways we could improve on the C6, when I asked whether we were going to look at anything more radical. The chief engineer asked what I had in mind and I said we should consider a mid-engine car, which was always promoted in the press as the next Corvette when I was growing up."

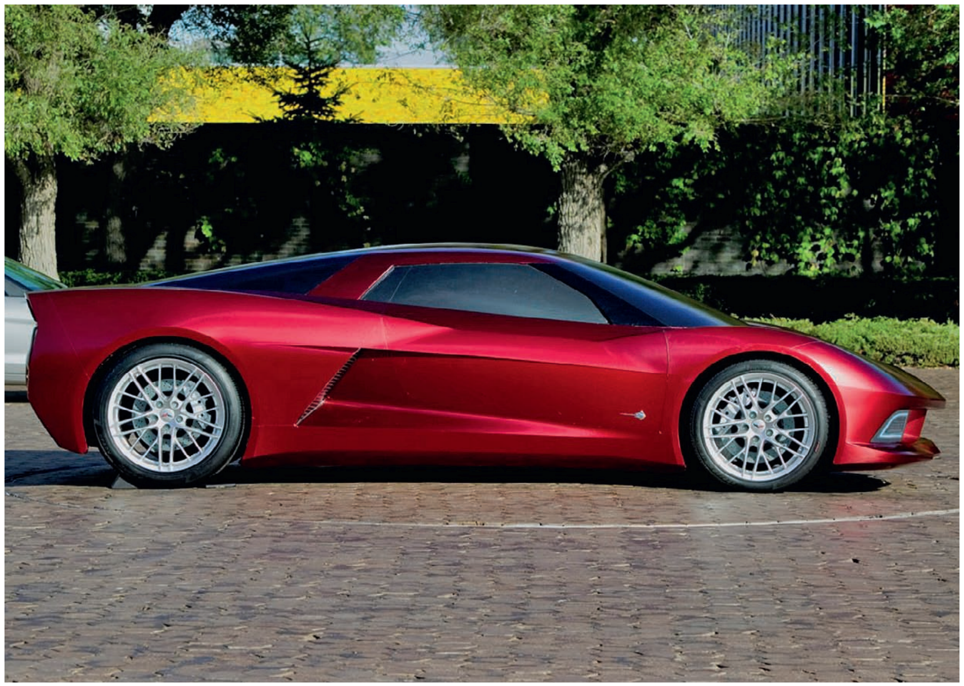
Those present in the planning meeting were intrigued and Charles was given one week to create a proposal. A week later he convinced his colleagues that it was worth studying to see if it was really possible to create a mid-engine design that offered substantially improved performance while retaining the practicality and functionality that helped define Corvette, all at a price point that kept it affordable for a very wide audience.

Charles' presentation made its way to the company leadership and, combined with design and engineering packaging confirmation studies, launched a program called GMX721, which would evaluate the viability of introducing a mid-engine C7. After creation of a full size clay the build a drivable mule was approved, but in December 2007 the program was cancelled because of GM's mounting financial difficulties.

Though GMX721 did not lead to a mid-engine C7, it did significantly advance the Corvette team's understanding of what it would take to produce a car with its engine behind the cockpit. It also engendered enthusiasm for a mid-engine Corvette within GM's top management ranks. Together, these results helped define C8 and laid the groundwork for its success.

WHY DID IT TAKE SO LONG?

The major performance benefits that result from locating a car's engine behind the cockpit were understood by some in the 1930s, and ably demonstrated by the impressively successful mid-engine Auto Union Grand Prix racers prior to World War II. Though there were certainly drawbacks to mid-engine architecture, production vehicles with mid- and rear-mounted engines began to appear just a few years after the war ended, and race cars at the highest level, such as the 1957 Cooper



T43, followed suit. By the dawn of the 1960s, mid-engine racers dominated open-wheel and sports-prototype racing, and mid-/rear-engine street cars from Porsche, Volkswagen, and others were commercially successful. So why did it take Chevrolet so long to produce a mid-engine Corvette?

The answer is simple. Until recently, it was impossible to produce a mid-engine road car that does everything well at a price point that is attainable for the average person. Since its inception, Corvette has offered exceptional performance, excellent safety, remarkable reliability and durability, genuine practicality, a high level of passenger comfort, and ample storage space, all at a surprisingly affordable price. Switching to a mid-engine configuration prior to 2020 would have necessitated sacrificing at least some of these desirable characteristics.

Recent advances in computer-driven design tools, materials science, and assembly methods enabled Chevrolet to produce an eighth-generation Corvette that offers all of the benefits of mid-engine architecture without compromising any of the attributes that have come to define Corvette. This was also possible because of the accelerated knowledge gained from more than two decades of uninterrupted racing and the high level of continuity among the engineers and designers responsible for Corvette that allowed them to leverage everything they had learned from developing previous-generation cars.

C8 STRUCTURE

A development team was created once the mid-engine Corvette was approved by GM management. Taking into account C7's performance parameters and benchmarking other manufacturer's mid-engine cars, primarily the Porsche 911 and Ferrari 458, the team established several lofty goals for C8 and began mapping out how to best reach them.

In order to achieve excellent stiffness with minimal weight, the engineers designed an aluminum space frame similar in concept to C7's structure but with several important innovations that make it 7 percent stiffer than its predecessor with the roof panel affixed and 12 percent stiffer without the roof. The C8 structure is created from a combination of fourteen aluminum stampings, extrusions, castings, and hydroformed tubes, and six sophisticated die-cast assemblies, augmented with a cast magnesium cross-car beam and instrument module.

The six die-cast assemblies, called nodes, which are produced at GM's powertrain plant in Bedford, Indiana, rely on a complex array of webbing to maximize strength and minimize mass with efficient packaging. The structure's 12-inch (30.48-centimeter) tall central tunnel, formed from stampings and extrusions, contributes so much to overall stiffness that the side rockers can be short, making for easy occupant ingress and egress. The components and assemblies comprising the space frame are joined with structural adhesive, welding, rivets, bolts, and flow-drill screws.

Forged aluminum control arms anchor each wheel assembly to the body structure. Springing and damping are accomplished by coil-over shocks and, as before, Magnetic Selective Ride Control is available. This technology, originally developed by GM's Delphi Automotive, which was acquired by Beijing West Industries (BWI) in 2005, uses a damper filled with magnetorheological fluid, sensors, and a control unit to instantaneously adjust damping to suit road conditions and driving mode.

Compared with C7, C8 gained weight in several areas. The new car's increased cooling capacity, larger rear wheels and tires, dry-sump lubrication, Tremec TR-9080 eight-speed dual-clutch transmission, and switch from transverse composite to coil-over springs all added mass.

To help offset these gains, engineers incorporated several innovations. The hollow rear bumper beam, sourced from Shape Corporation, is crafted from carbon fiber using pultrusion technology developed by Thomas Technik + Innovation GmbH. Carbon fiber soaked with urethane-acrylate resin is drawn through a die, yielding an extremely strong beam weighing only 4.9 pounds (2.22 kilograms).

In a similar vein, the center tunnel close-out panel is manufactured using the PRIME liquid composite molding process developed by Molded Fiber Glass (MFG), a company that has supplied Chevrolet with Corvette parts since 1953. MFG sandwiches two carbon fiber and three fiberglass sheets soaked with vinyl ester resin and molds them under pressure to create a strong, lightweight panel. MFG also supplies ultralight SMC floor panels and luggage compartment bins.

TESTING THE C8 STRUCTURE AND SUSPENSION

After much thought went into C8's structure and suspension, and a series of advanced computer simulations were executed to help define their validity, GM's Advanced Vehicle Integration (AVI) team at the Warren, Michigan, Tech Center built the first C8 test vehicle. AVI builds all of GM's early development and concept vehicles, but nothing they had done before was as challenging at the first C8, which they code-named *Blackjack*.

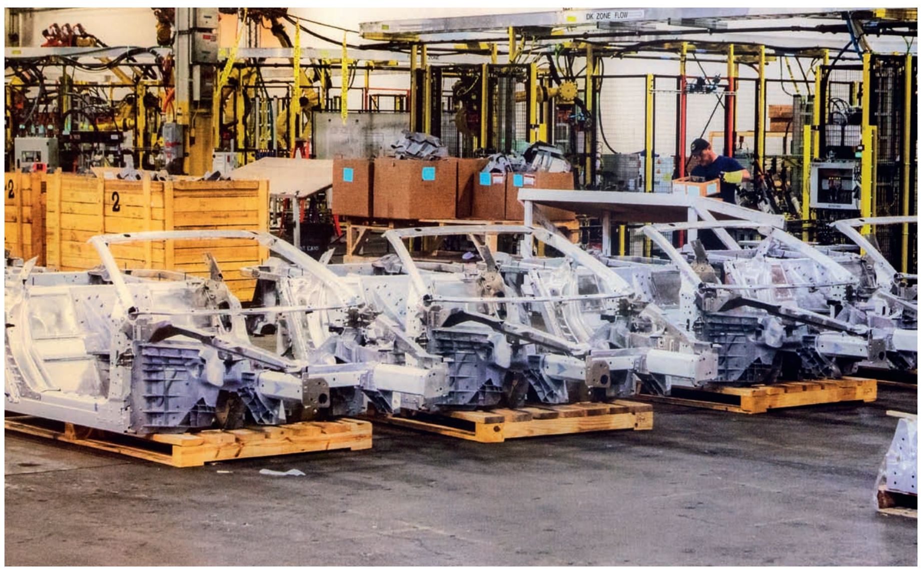
A new vehicle is normally an evolution of something that already exists, so AVI has a starting point to modify and build around—but the C8 was truly all new, so they had to start from scratch. Working in great secrecy, they machined, from billet aluminum, all of the elements of the C8's proposed backbone body structure, incorporating considerable suspension adjustability for the bolt-on elements that would allow them to test a wide range of attachment points and other variables.

At this early stage of the development process, the team sought only to evaluate whether their computer design tools were leading them in the right direction regarding body structure goals and suspension kinematics. Critical considerations required to accurately represent the new Corvette's structure and suspension included total mass, weight distribution, wheelbase, front and rear track, and occupant positioning. Engine power, passenger accommodations, and a long list of other factors were essentially irrelevant. It therefore didn't matter how the nonstructural areas of the car looked or how they performed. The vehicle had to be drivable, however, and crucially, it needed to be so well disguised that nobody outside the development team could recognize it as a mid-engine Corvette.

For functionality, AVI created a cockpit using mostly C7 parts, including the roof, windshield header, and door structures. Electric modules, cooling and brake systems, and an LT1 engine also came from C7. The LT1 was mated to a ZF seven-speed dual clutch automatic.

Blackjack still needed a body. The C7 wouldn't work in this regard because its short rear deck and long nose had the wrong proportions for a mid-engine layout. Besides, the build team didn't want anything about the test mule's appearance to

▼ The C8 structure is created from a combination of aluminum stampings, extrusions, castings, hydroformed tubes, and six sophisticated die-cast assemblies, augmented with a cast-magnesium cross-car beam and instrument module.



▶ The first heavily disguised C8 test vehicle, called *Blackjack*, was built by GM's Advanced Vehicle Integration (AVI) team at the Warren, Michigan, Tech Center in order to evaluate body structure, suspension kinematics, and other aspects of C8.

◀ The C8 convertible body being brought to life in clay.

▲ Technicians hand-built the first C8 test mule's body, based on the appearance of a Holden SS-V Ute, which is a passenger-car-based pickup truck, because its pickup bed could be adapted to house the new Corvette's engine.

even hint at Corvette. To that end, they looked to a most unusual vehicle for inspiration: a Holden SS-V Ute, which is a passenger-car–based pickup truck produced by GM's Holden Division in Australia. While the SS-V Ute's dimensions were wrong, with a body 18 inches (45.72 centimeters) longer and a wheelbase nearly 12 inches (30.48 centimeters) longer than the C8's, its pickup bed could be adapted to house the new Corvette's engine and drivetrain.

Rather than try to use an actual SS-V Ute body, AVI drew inspiration from it. They used the Holden pickup's front fascia, headlights, taillights, and side-view mirrors and then fabricated new body panels that sort of resembled an SS-V Ute from fiberglass and carbon fiber to fit over *Blackjack's* structure and mechanical parts. Massive fender flares were added to house wide wheels and tires, and an inverted wing was mounted to the rear to provide enough lift to balance the lift inherent in the body's front end.

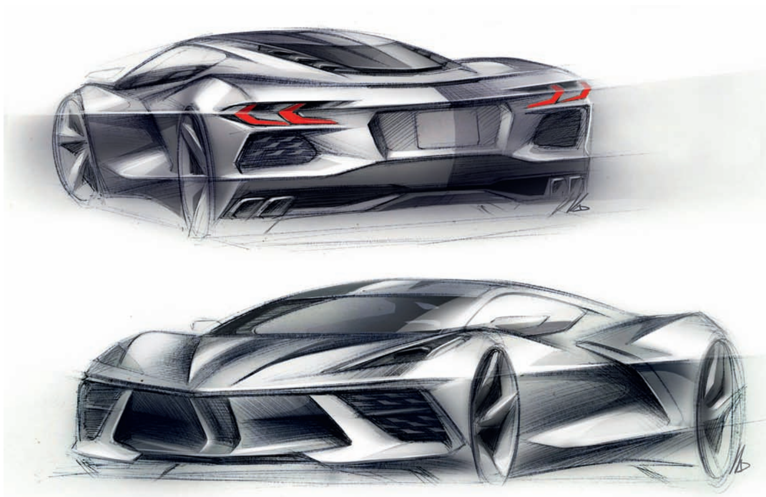
After two years of continuous testing with *Blackjack*, architectural test mules that were much closer to a finished C8 had been built and were running. These cars had the finalized body structure, LT2 engine, Tremec DCT transmission, braking system, suspension components, electric modules, body panels, and major interior hardware. A total of eleven architectural mules were constructed, and ultimately five of them were crash-tested.

For the third major stage of development, over one hundred prototype C8s were created. To evaluate and improve the build process, these were put together on a simulated assembly line. By this point, all of the new Corvette's major parameters were solidified, so these cars were used to fine-tune nearly every aspect of the car.

C8 EXTERIOR

The Corvette design team, working under GM Global Design Vice President Michael Simcoe, faced monumental challenges when it came to styling the C8. The body had to accommodate the proportions unique to mid-engine architecture, look stunning, enhance the car's ultra-performance capabilities, respect Corvette's unbroken history of attainability, and be unmistakably a Corvette.

▲ Certain features of C8 exterior design, especially the shape of the nose, headlamp assemblies, and grille opening, make it unmistakably a Corvette.



▶ These sketches by Vlad Kapitonov, design manager of the Performance/Motorsport/Accessory Studio at GM, capture the essence of where the Corvette design team went with C8.

The design team used a combination of advanced tools, such as computational fluid dynamics, alongside traditional methods like clay modeling to solve C8's biggest technical challenges. Chief among these was getting to a low coefficient of drag to help minimize fuel consumption and maximize speed while simultaneously generating balanced downforce. Lower drag and higher downforce are normally opposed to one another, but things like sophisticated surfacing and a flat, smooth underside enabled the team to find the right balance. A Z51-equipped C8 Stingray will generate 400 pounds (181.43 kilograms) of downforce while still enjoying a coefficient of drag of only 0.322.

Another consideration that is usually at odds with, but equally important to, drag and downforce is cooling. The more capable a car is, the more air it needs to help cool engine, drivetrain, and brake components, but diverting air from its flow over the car's surfaces can increase drag and decrease downforce. The cooling challenges were amplified significantly with the change to mid-engine architecture because it placed the engine and transmission far away from the air intake points and heat exchangers.

The designers and engineering team, led by Tadge Juechter, who calls C8's cooling system the single most challenging aspect they faced, came up with some innovative solutions. To maximize the cooling system's performance with the car at or near its limits in 100-degree-Fahrenheit ambient conditions, they placed two radiators in the front right behind large intakes in the corners of the front fascia and a third behind the left side air scoop. Airflow coming in from the side scoops is channeled toward the car's centerline so it can pass over the exhaust manifolds and engine. It's then exhausted through large outlets in the corners of the rear fascia. Small electric fans aid the flow of air to these outlets when conditions warrant, and vents on either side and at the trailing edge of the rear glass hatch also allow air to escape from within. Cooling is further aided by large lubricant-to-coolant heat exchangers for both engine and transmission oil.

After all functional and practical considerations were addressed, the designers still had to create a car that was distinctly a Corvette. This was helped in no small measure by the fact that many of them, including Kirk Bennion, Tom Peters, John Cafaro, Hwasup Lee, Brad Kasper, and Vlad Kapitonov, had worked on C7, C6, C5, and even C4. The final design for C8 incorporates key elements that evoke important cues from prior-generation Corvettes and, perhaps more importantly, communicates an overall look that is unmistakably Corvette. This is most apparent in the C8 nose, which bears a strong resemblance to the C7 nose in terms of surfacing, hard crease lines, fender peaks, headlamp shape, and grille opening.

▲ *Left to right:* Designers Brian Stoeckel, Tristan Murphy, and Ryan Vaughan evaluate a C8 interior mockup.

◀ As with the exterior, every detail of C8's interior was modeled full-size in clay for evaluation.

▼ Corvette interior design manager Tristan Murphy and his team drew inspiration from a wide range of things as they worked out every detail of C8's interior. These included some of the world's most expensive supercars, fashion, luxury leather goods, and architecture.

▶ Aviation-inspired twin-cockpit motif goes back to C2, but liberal use of Napa leather, aluminum, carbon fiber, magnesium, and other ultra-premium materials makes C8's interior stand out from all previous Corvettes.

▶▶ C8 interior designers worked hard to ensure that the 2020 Corvette's cockpit was the best in Corvette history.

C8 INTERIOR

As with its exterior, designers were challenged with creating a completely new interior for C8 that was consistent with the car's performance, continued the drive to significantly improve materials and execution, and left consumers and competitors wondering how Chevrolet could offer so much in a car that's so affordable.

Corvette Interior Design Manager Tristan Murphy and his team drew on their varied experience and looked at a wide swath of vehicles for inspiration. Among them were many of the world's most expensive supercars, including Bugattis, Ferraris, and Lamborghinis. The goal wasn't to imitate these exotics, but rather to come to a better understanding of how their creators utilized materials, shapes, surface textures, colors, light, shadow, and even empty space to craft a memorable experience for driver and occupant. They also looked beyond the automotive world, at things ranging from leather goods to clothing, footwear, and architecture to further their efforts to totally reimagine Corvette's interior while still maintaining a bond with the nameplate's heritage.

A defining theme for the C8 interior, which goes back to C2 and even before then, to concept cars and one-off racers from the 1950s, is the jet fighter motif. Though not as symmetric as they were in earlier generations, two distinct cockpits still envelop both driver and passenger. This traditional layout is however completely modernized with liberal use of Napa leather, aluminum, carbon fiber, magnesium, and other ultra-premium materials and design considerations for virtually everything inside the car that contributes to functionality, comfort, and maximizing both driver and passenger visibility.

POWERING THE C8

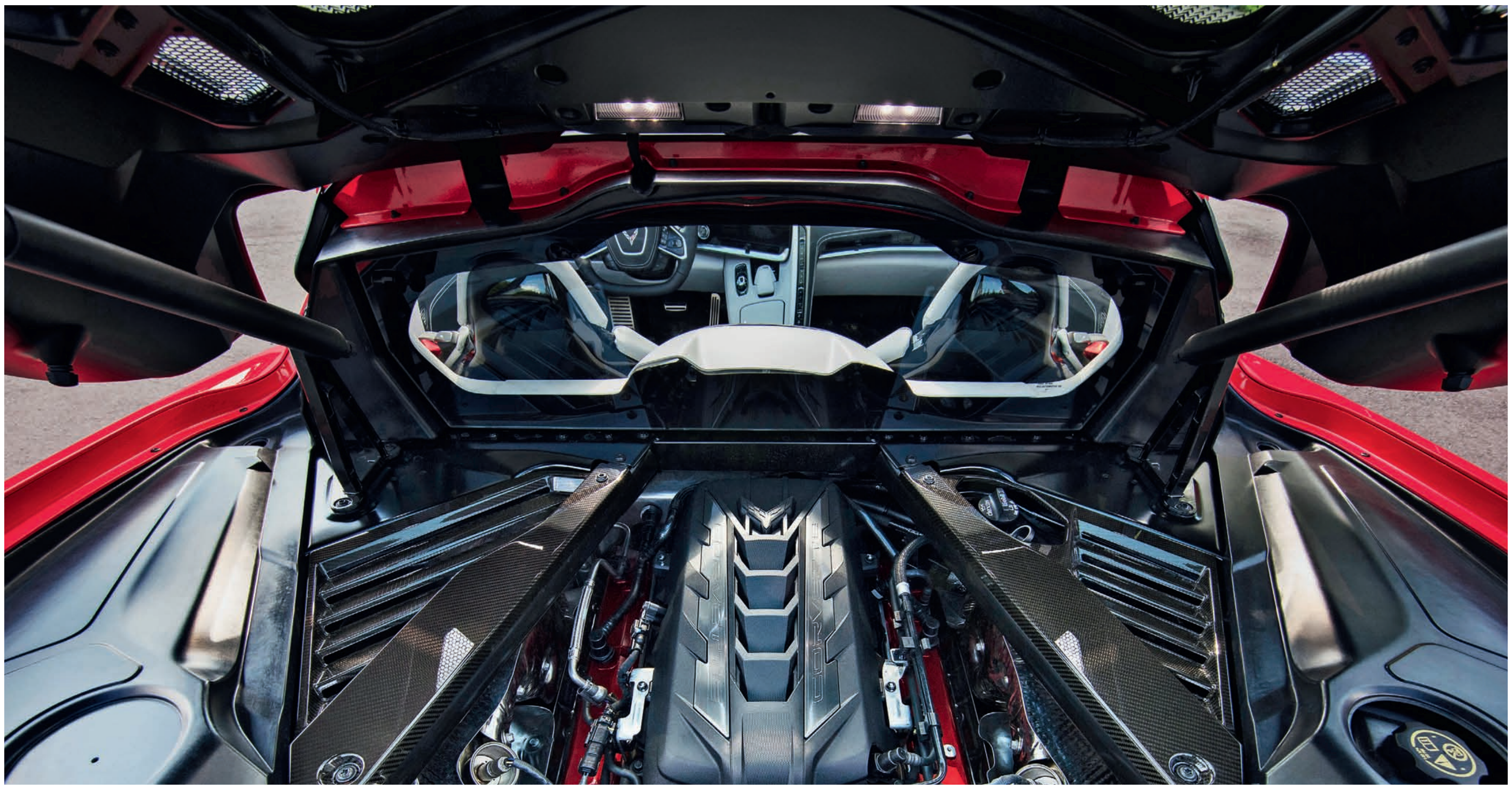
The base C8 is powered by the newest iteration of Chevrolet's venerable small-block V-8, called LT2. Created under the leadership of Global Chief Engineer for small-block engines Jordan Lee and Assistant Chief Engineer for small-block engines Mike Kociba, the LT2's fundamental architecture and many of its features, including 4.40-inch (11.176-centimeter) bore spacing, 4.065-inch (10.32-centimeter) bore and 3.622-inch (9.2-centimeter) stroke, direct injection, and 11.5:1 compression ratio carry forward from the preceding LT1, but a great deal was also changed to enhance durability, improve power and efficiency, and accommodate the unique requirements of a mid-engine layout.

One area that changed significantly is the engine's breathing system. The intake and exhaust manifolds were completely redesigned for maximum efficiency within the constraints dictated by the engine placement. A shorter intake tract routes incoming air to a rearward facing 87mm throttle body. A new intake manifold with 210mm runners is tuned for maximum torque and horsepower. Because engineers didn't have to concern themselves with obstructing the driver's view of the road, they could design a taller intake plenum with 16.0 liters of volume, versus the LT1's 13.5 liters. The intake is injection molded using BASF's Ultramid, a glass-reinforced nylon.

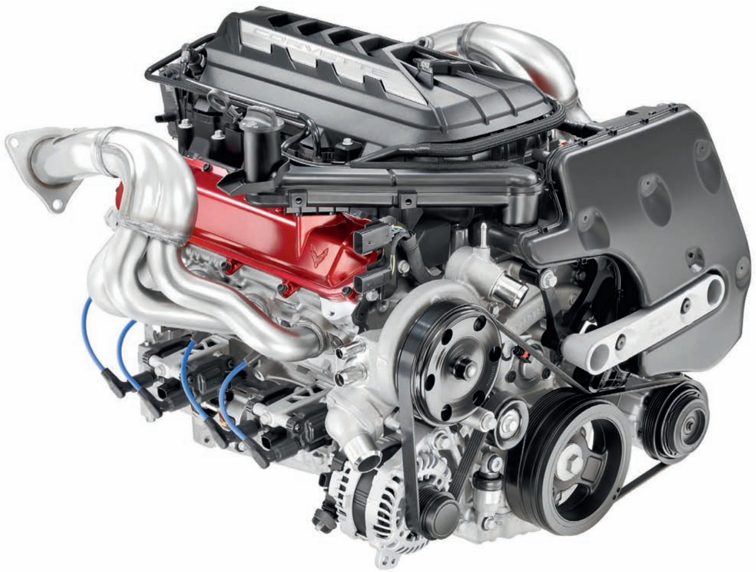
Another thing that changed considerably was the engine's oiling system. Dry-sump lubrication, previously available on only Z51-equipped and other higher-performing models, was made standard to allow for lower mounting of the engine. To diminish the flow of oil from the top of the engine down into the crankcase, and thus reduce aeration and frictional loss caused by the bottom end's rotating mass having to pass through the descending oil, the lifter valley is completely sealed. A gerotor pump driven by the camshaft sends oil in the valley back to its sump, which like the intake is molded from Ultramid.

As with its deep-skirt block, LT2's heads are cast from A319-T7 aluminum. They are nearly identical to LT1 heads, but the new engine's billet steel camshaft is markedly different. The increased efficiency of the induction and exhaust systems allows for a more aggressive cam profile, with valve lift increasing from 13.5mm to 14.0mm and duration increasing 18 degrees for exhaust and 4 degrees for intake. The new camshaft specifications, along with more efficient intake and exhaust systems, largely account for the LT2's prodigious power output. Horsepower peaks at 495, which is 35 more than LT1, and torque increases by 5 lb-ft to 470 lb-ft (7.44 to 699.44 kilograms per meter).

To the disappointment of some, C8 is available only with an automatic transmission. Unfortunately, no manual transmission that meets all requirements necessary for a C8 exists and, given the relatively low demand (over the six-model-year lifespan of C7, orders for manual transmission cars fell



◀ Under the leadership of Tom Peters, designers devoted a lot of attention to the aesthetics of the C8 engine and everything surrounding it.



▶ The base C8 LT2 engine, built around a block and heads cast from A319-T7 aluminum, produces 495 horsepower and has some unusual features, including upward-sweeping exhaust headers, designed to meet the packaging requirements of mid-engine architecture.

▶▶ The only available transmission for C8 is a Tremec dual-clutch automatic, which can shift gears in fewer than 100 milliseconds.

▼ Mid-engine architecture, combined with advanced technology in everything from its tires to its electronic chassis controls, makes C8 the best-performing Corvette ever produced.

steadily each year, from a high of 50 percent in 2014 to less than 20 percent in 2019), the immense design, development, and tooling costs to create one cannot be justified.

The only available transmission is a dual-clutch automatic (DCT) supplied by Tremec. The newly designed eight-speed transmission uses two internal shafts, with one containing the even-numbered gears and the other holding the odd-numbered gears. The mechanical design and sophisticated electronic controls enable the transmission to disengage a gear on one shaft while simultaneously engaging a gear on the other shaft, allowing for shifts in fewer than 100 milliseconds.

A super-low first gear takes full advantage of the mid-engine Corvette's rearward weight bias and allows for fantastic off-the-line acceleration. Second through sixth gears are closely spaced to keep the engine at the sweet spot in its powerband and deliver startling performance or effortless cruising at any road speed. Seventh and eighth are overdrives that yield a top speed north of 180 miles per hour (289.68 kilometers per hour) and keep revs low enough at high cruising speeds to earn a 27-miles-per-gallon (11.49-kilometers-per-liter) highway rating.

▶ The beautifully integrated complexity of C8's body surface is apparent in this overhead view.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RACING THE MID-ENGINE C8

The introduction of Chevrolet's C8.R opened the next chapter in Corvette's illustrious racing history. Building on a twenty-plus-year legacy of success around the globe, the team of experts responsible for Corvette Racing crafted a beautiful new car that was a complete departure from all that came before, and yet was the closest to its production counterpart of any Corvette racer since the C5.R hit the track in 1999. This symbiosis between the road and racing versions of the new Corvette went back to the fact that they were developed simultaneously from beginning to end, which did not happen with prior-generation Corvettes.

◀ Corvette Racing celebrated the 2021 debut of the C8.Rs at Le Mans with a special team photo.

"Historically, there is a serial relationship," explained Corvette Chief Engineer Ed Piatek. "We had the C5 on the road in 1997 and started to develop that race car for the 1999 season. Many things we learned there were part of the tech transfer that went into C5, then C6 into C6.R, and so on, but in this case, we had a clean sheet of paper for both cars and had a chance to design and develop them together for the first time ever. As a result, there is a deeper level of technology transfer between the 2020 Corvette Stingray and the next-generation Corvette race car than ever before."

The closer-than-ever relationship between the race and production cars was made possible by the most extensive use of extremely advanced computer analytics ever applied in Corvette's history. These tools empowered the engineers to start the design of the race car well in advance of any production Corvette components being available. Chevrolet's state-of-the-art Driver-in-the-Loop Simulator was heavily utilized to evaluate numerous chassis and aero design concepts before a single part was produced. And when an idea looked promising, the engineering and design teams were able to quickly and precisely make thousands of 3D-printed rapid prototype parts for analysis.

All told, the race and road cars share eighty different major components, chief among which is the chassis structure, made in Corvette's Bowling Green assembly plant with a sophisticated combination of riveted, flow-drill screwed, and bonded-aluminum components. This structure is lighter and stiffer than any previous Corvette chassis. Stiffness is further increased for the C8.R with the addition of a full safety cage.

While race and production cars share the same basic short-arm/long-arm double-wishbone design suspension, and suspension pickup points, they don't use the same components. The C8 relies on forged-aluminum upper and cast-aluminum lower arms, while the race car uses fabricated steel arms all around. And in accord with the rules governing FIA World Endurance Championship (WEC) and IMSA racing, the C8.R also has different shocks and brakes. The race-car shocks are adjustable coil-overs, and the brake system includes Alcon monobloc six-piston front and four-piston rear calipers squeezing steel rotors.

As with prior-generation race cars, the C8.R body is a slightly wider and lower version of its street counterpart, made entirely with lightweight carbon fiber. The C8.R measures 80.7 inches (204.98 centimeters) wide and 45.1 inches (114.55 centimeters) high, versus the C8 Z06 at 79.7 inches (202.44 centimeters) wide and 48.6 inches (123.44 centimeters) high. More than ever, aerodynamic efficiency drove the design of the body, and the new mid-engine architecture allowed for significant improvements compared with earlier-generation Corvettes. This was particularly true for the race

▶ Because they were designed simultaneously, there is a deeper level of technology transfer between the road-going C8 and C8.R race cars car than ever before.

◀◀ Wind tunnel testing helped engineers optimize the C8.R's aerodynamic performance.

◀ The same mechanics and technicians who assembled the C8.Rs serve as the crew for both testing and racing.

◀◀ As has happened with each generation of Corvette racer, the C8.R underwent extensive track testing prior to its debut at Daytona in 2020.

◀ Corvette Racing earned the first win with the C8.R, and the hundredth win in IMSA competition since 2000, at Lime Rock on July 4, 2020.

car because the C7.R was not able to take full advantage of a 2016 FIA/IMSA rule change that allowed for larger front splitters and rear diffusers. At the time, it wasn't feasible to make substantial changes to the C7.R chassis and suspension that would have created room for larger aero parts. But in creating the new car, engineers were able to incorporate the larger splitter and diffuser into their plan from day one, designing the adjacent structures around them. Finding space for the front diffuser was relatively easy given that the engine is not in the way, but the rear is quite a bit more complex. One big help is a new, more compact sequential six-speed gearbox designed specifically for the C8.R by technical partner Xtrac.

On the body's top surfaces, most of the basic aero goals were the same for the race and street car. Both need to slip through the air with minimal drag to reduce fuel consumption, and both need balanced downforce between the front and rear. Another aspect of handling airflow over, under, and through the body, and one that was especially challenging for both the street and race cars, pertained to thermal management. With previous-generation Corvettes, the two biggest generators of heat, the engine and gearbox, were at opposite ends of the car, so their thermal loads could be managed separately. In the C8 and C8.R, with the engine and gearbox together, it's more difficult to keep them and the parts surrounding them sufficiently cool.

To help address this in the C8.R, designers placed the engine's air intake at the base of the rear window. While this has a slightly adverse impact on airflow to the rear wing, it does free up the large air intakes on either side of the car, which are used primarily for engine-induction air on the street car, to help with cooling. Also helping manage heat load at the rear is placement of the engine's radiator up front, in the center area allocated for storage in the street car. After air passes through the radiator, it exits by way of ducts behind each front wheel.

In keeping with IMSA/WEC rules, the C8.R's engine displaces 5.5 liters. While this is the same size as the C7.R's engine, the two powerplants share almost nothing in common. The new engine, a radical departure from anything seen in a Corvette race car before, is a naturally aspirated, dual-overhead-camshaft, four-valve-per-cylinder, flat-plane crank V-8. The four-valve cylinder heads breathe better, and the absence of counterweighting on a flat-plane crankshaft makes the engine much more responsive. Though unknown to the public when the C8.R was unveiled, this all-new engine, called LT6.R in the race car, would make its production debut as the LT6 in the 2023 Z06.

The C8.R's clean-sheet design and mid-engine architecture yielded lighter, stiffer race cars with better aerodynamics, improved weight distribution, faster responsiveness, and a host of other enhancements. Combined, these attributes helped Corvette Racing sweep the IMSA GTLM manufacturer, team, and driver championships in 2020 and 2021.

THE FUTURE OF CORVETTE RACING

There's no doubt that Corvettes will continue racing into the foreseeable future, given the huge, intensely passionate fan base the nameplate enjoys around the world, and the strong support for racing Corvettes that is deeply rooted in GM's top management. There are, however, going to be some significant changes in who races Corvettes, where, and when.

After IMSA's GTLM class was eliminated at the end of the 2021 season, Corvette switched to the newly formed GTD PRO category for 2022. This new class was created when the

▲ Corvette Racing's driver lineup for the 2021 championship-winning season included, *left to right*, Nicky Catsburg, Jordan Taylor, Antonio Garcia, Tommy Milner, Nick Tandy, and Alexander Sims.

▶ The C8.R race cars use a specially prepared version of the naturally aspirated, dual-overhead camshaft, four-valve-per-cylinder, flat-plane crank V-8 found in the 2023 Corvette Z06.

▼ Smoky burnouts out of the pit stop box help warm up fresh tires.

series divided GTD, which is for GT3 homologated cars, into GTD PRO and GTD, with PRO cars having only professional drivers and GTD cars having at least one driver classified as an amateur. Chevrolet received a waiver to compete in 2022 IMSA races with GTE/GTLM-homologated C8.Rs modified to conform to GT3 specifications while work got underway to design, build, and test a new GT3-spec Corvette, called Z06 GT3.R, which will begin racing in 2023. If participation in the IMSA GTD PRO class remains strong beyond 2022, it is likely that this class will endure, and that Chevrolet will continue to field a full factory effort there with its new Z06 GT3.R Corvettes.

In keeping with regulations, GT3-class cars must be offered for sale to privateer racers. As such, starting in 2023 for the 2024 season, Chevrolet will sell Corvette Z06 GT3.R race cars. Though demand can't be predicted with certainty, Laura Klauser, GM Sports Car Racing Program Manager, expects to

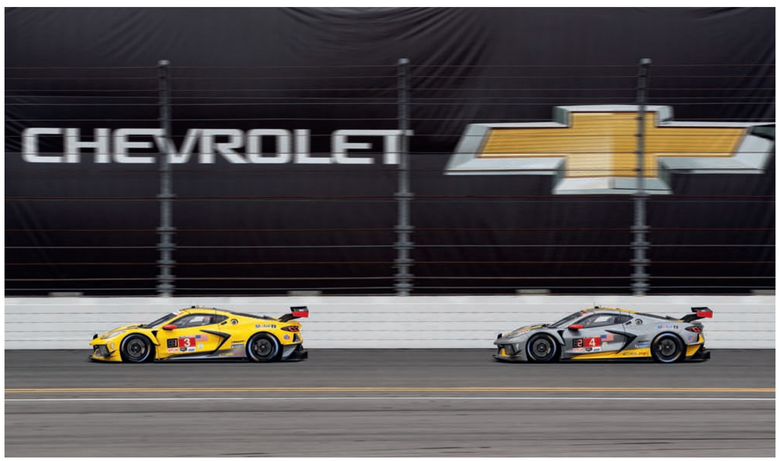
▲ The C8.R race cars, which are full of highly sophisticated electronics essential for their operation, must be able to stand up to foul weather every bit as well as production Corvettes.

▶ The C8.R is a slightly wider and lower version of the production Corvette Z06, measuring 80.7 inches (204.98 centimeters) wide and 45.1 inches (114.55 centimeters) high, versus 79.7 inches (202.44 centimeters) wide and 48.6 inches (123.44 centimeters) high.

▶ The C8.R's, which are the lightest, stiffest, and best balanced Corvette racers ever created, carried Corvette Racing to the IMSA GTLM manufacturer, team, and driver championships in 2020 and 2021.

▼ The C8.Rs dominated the 24 Hours of Daytona in 2021, leading GTLM for 716 of the race's 770 laps and finishing one-two, with victory going to the No. 3 Corvette of Antonio Garcia, Jordan Taylor, and Nicky Catsburg.

▶▶ Races are often won or lost in the pits, and nobody gets their cars serviced and back out in the race faster than the Corvette team.



sell approximately ten Z06 GT3.R race cars in 2024 and another ten in 2025. The buyers will be getting a highly competitive car eligible to race in a wide variety of GT3 championships and marquee events around the world, including the Asian Le Mans Series, ADAC GT Masters, Australian GT Championship, European Le Mans Series, various SRO Motorsports Group series, Nürburgring 24 Hours, and 24 Hours of Spa.

In addition to racing in IMSA's GTD PRO class in 2022, Chevrolet is also running a C8.R in the GTE PRO class in WEC. This series races all over the world, and France's 24 Hours of Le Mans is its premier event. With the exception of 2020, the Corvette program has competed at Le Mans every year since 2000, and has done some additional WEC events in recent years, including a race in Shanghai in 2018 and one at Spa-Francorchamps in 2021, but 2022 marks the first time a Corvette will compete in every WEC race.

While it is likely that factory teams will remain in IMSA's GTD PRO category in the future, the fate of factory GTE programs in WEC is uncertain. In August 2021 the Automobile Club de l'Ouest (ACO) announced that it will replace its GTE PRO and AM categories with a new class for GT3 cars starting in 2024, though the sanctioning organization has not revealed whether it will divide GT3 into AM and PRO categories. Therefore, as of this writing, it is unknown whether in 2024 and thereafter Chevrolet and other manufacturers will be able to enter full-factory efforts in WEC and its Le Mans 24-hour race.

The situation in WEC and Le Mans is equally cloudy for 2023. While the ACO has said that GT3 will replace GTE starting in 2024, which clearly implies that GTE will remain in existence for 2023, it's not clear that GTE PRO will still exist in 2023.

While the future of a full-factory Corvette race team in WEC beyond 2022 is tenuous, this does not mean Corvettes won't be racing in this championship series and at its signature event in Le Mans. Even absent a full-factory effort, it is certain that factory-supported privateers will be there with Z06 GT3.Rs after 2022. Given the totality of circumstances, Corvette fans everywhere can be thankful for that.

◀ Because of these people, and all those who came before, Corvette Racing is the most successful GT racing team of the modern era.

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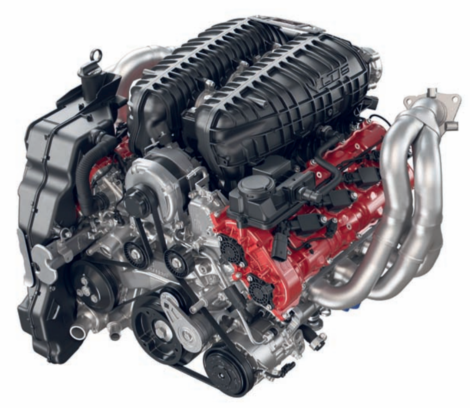
LOOKING AHEAD

As the millions of people around the world who love Corvette celebrate its seventieth anniversary, the future for America's beloved sports car has never been brighter. While the base C8 Stingray offered new levels of performance, it was just the beginning, as evidenced by the Z06, unveiled in October 2021. The C8 Z06 is essentially a race car capable of generating 1.22 g of lateral force and sprinting from 0 to 60 miles per hour (0 to 100 kilometers per hour) in 2.6 seconds, and yet it's docile enough to drive on the street every day, courtesy of incredibly sophisticated technology and equally brilliant engineering.

◀ Though the 2023 Z06 is among the fastest cars in the world, it's full of luxury features and well behaved enough to carry its owner to work and back every day.



▲ The LT6 engine is a completely new 5.5-liter V-8 with dual-overhead-camshafts, flat-plane crankshaft, forged-aluminum pistons, forged-titanium rods, active-split-intake manifold, dry-sump lubrication, stainless headers, and a long list of additional features that contribute to its, strength, efficiency, and power.

▶ To minimize mass and maximize performance for Z06, Chevrolet offers Brembo-supplied carbon-ceramic brakes as part of the Z07 package and these carbon fiber wheels, which eliminate 41 pounds (18.59 kilograms) of unsprung weight.

▶▶ Z06 interior, every bit as luxurious and beautiful as the standard cockpit, is easily identified by its unique steering wheel.

The heart of the Z06 is its LT6 engine, a completely new 5.5-liter V-8 that features dual-overhead-camshaft cylinder heads with CNC-machined combustion chambers and intake ports, titanium intake and sodium-filled exhaust valves, a forged flat-plane crankshaft, forged-aluminum pistons, forged-titanium connecting rods, an active split-intake manifold with twin 87mm throttle bodies, a six-stage ten-quart dry-sump lubrication system, four-into-two-in-to-one stainless-steel exhaust headers, and a long list of additional features that contribute to its strength, efficiency, and power output. Producing 670 horsepower at 8,400 rpm and 460 lb-ft (684.55 kilograms per meter) of torque at 6,300 rpm, it is the most powerful naturally aspirated V-8 GM has ever manufactured, and as of this writing it is the most powerful naturally aspirated production engine in the world.

Z06 performance is augmented by various electronic chassis control systems, including launch control, active handling, traction control, performance traction management, and an electronic limited slip differential. It's fitted standard with a highly effective Brembo brake system that uses six-piston front and four-piston rear calipers squeezing steel rotors, and a carbon ceramic brake package is optional.

The exterior of Z06 is easily distinguished by virtue of bespoke fenders, quarter panels, and fascias, which together make it 3.6 inches (9.14 centimeters) wider than a base C8. Standard Z06 aero features include a rear spoiler with replaceable wicker bills, rear-brake cooling ducts, removable front fascia panel, and front underwing stall gurneys, all designed to optimize drag and cooling efficiency while increasing downforce.

The optional Z07 performance package includes a larger front splitter, front dive planes, a pedestal-mounted rear wing, and underbody strakes, all of which enhance downforce. Z07 also includes carbon ceramic brakes, FE7 suspension with specially calibrated Magnetic Ride Control, and Michelin Sport Cup 2 R ZP tires. For maximum performance, carbon fiber wheels, which eliminate 41 pounds (18.59 kilograms) of unsprung weight, can be ordered.

As of this writing, the C8 Z06 is the highest-performing Corvette available. Though GM doesn't discuss future models, it's logical to assume that even more capable Corvettes will be produced in coming years. One fascinating iteration, which will likely be called Corvette E-Ray based on GM trademarking that name in 2015, may be an all-wheel-drive gasoline–electric hybrid, with the base Stingray's 6.2-liter LT2 V-8 powering the rear wheels and either one or two electric motors powering the front wheels. Another possible hybrid configuration entails incorporating a motor-generator into the car's transmission. Tremec, which supplies C8's eight-speed DCT automatic, filed a patent application in 2019 for this same type of transmission with an integrated motor-generator. Besides improving efficiency and reducing emissions

◀ A Z06 is 3 inches (7.62 centimeters) wider than a standard C8 by virtue of different fenders, quarter panels, and front/rear fascias.

by allowing for electric-only or electric-augmented operation, the hybrid arrangement would increase performance by adding more horsepower and, possibly, all-wheel-drive. The total power output and resulting performance of the E-Ray will most likely fall between the base Stingray and Z06.

Based on credible rumors circulating for the past several years, as well as the recent history of Corvette model offerings, we are likely to see an ultimate C8 that combines electrified all-wheel-drive and a twin-turbo version of the DOHC flat-plane-crank V-8 powering the Z06. Again, based on trademark registrations GM has secured in the United States and around the world, this model is expected to be called Zora, in honor of Corvette's first chief engineer, who fought mightily to convince GM to build a mid-engine version of the car. Together, the LT7 twin-turbo DOHC V8 and electric motors would almost certainly deliver at least 1,000 horsepower and equally impressive torque figures.

Combined with its highly sophisticated chassis and aerodynamically efficient body, the Zora would offer performance unprecedented for actual production cars. And in a fitting tribute to those who created America's sports car, and the countless men and women who have nurtured, defended, guided, and loved it in the intervening seventy years, it would do so in a package offering levels of comfort, luxury, safety, beauty, and value that make Corvette stand alone among the world's greatest supercars.

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Last, but certainly not least, I offer my heartfelt gratitude to the people at GM I've been privileged to work with over the past twenty-five years. Your commitment to make the greatest sports car in the world even better is inspiring, and your support for me is deeply appreciated.

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