THE SCIENCE OF BUICK

An Introduction to the Science of Buick.

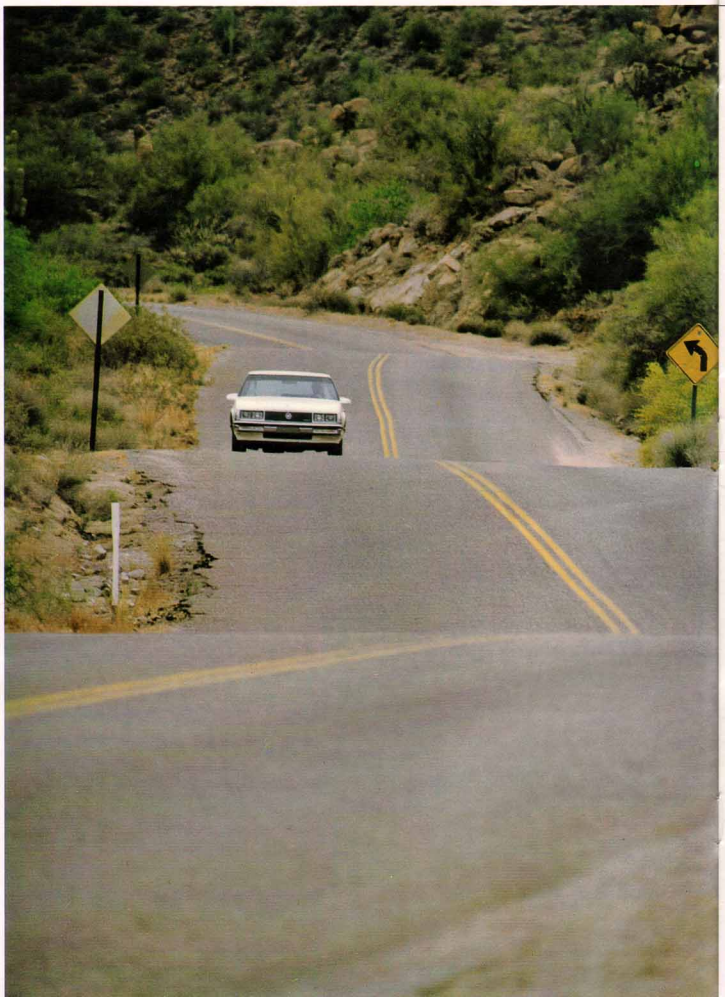
At first, it is just a spot on the horizon, a tiny cloud of dust reflecting an afternoon sun that has turned the Australian Outback into a shimmering furnace. As the cloud moves closer, bright pinpoints of light appear at its base. Closer, and the pinpoints become the headlights of an automobile that slowly takes shape in the cloud of dust billowing behind. And now there is sound to go with this desert apparition, the sound of a high-performance engine working at its upper limits, thriving on the scorching desert air. The car screams past. Tires, fighting for purchase on the unpaved surface, rain a shower of pebbles on the group of engineers gathered on the shoulder. And with a sudden rush, the car, the cloud, the sound, all disappear in the distance, the only evidence of their passing a layer of fine dust that has settled over the equipment the men are clustered about.

The car, a prototype of the new Buick Electra; the men, technicians from Buick's engineering and testing departments; and the event, dramatic though it may seem, but a single frame of a complex test scenario that has begun months beforehand, and at that point still has months to run.

A new car doesn't suddenly appear on a showroom floor by some act of industrial magic. It is the end product of a long, complicated, involved process, a process that has always called upon the latest developments in science and technology.

The first Buicks produced were, by today's standards, primitive devices, little more than engines and seats bolted to a collection of iron rails. But even then, the science and technology that went into those simple creations was considerable.

And the science and technology that go into today's newest Buicks are still, even in this age when the almost unbelievable has become commonplace, quite incredible. This book is a look at some of those marvels, and what it takes to make a Buick a Buick.



Where does a Buick come from? From assembly plants in places such as Flint, Michigan and Wentzville, Missouri, of course. But before that. Before all the pieces are welded and screwed and bolted together. Even before the designers and engineers sharpen their pencils—or, as is more likely these days, switch on their computers—to begin their particular forms of creative magic. The answer is, from an idea.

The idea can be brand-new, like the idea that became the new Buick Somerset, or the idea can be an innovative variation on an existing theme, like the exciting new Electra.

The idea for the Electra began to blossom more than four years ago when it became apparent that an era represented by the traditional size, shape, weight and mechanical systems of the then-current Electra was rapidly nearing its end and that a new era was beginning, typified by aerodynamic styling, lighter weight, smaller engines, front-wheel drive and electronic technology. In fact, front-wheel drive and efficient packaging were already on the road in the Skylark, and planning was well along for the Century which would be, at its 1982 introduction, a breakthrough in aerodynamics and design philosophy.

The new Electra would be, as Buicks have always been, a car for its time.

But in addition to the commitment to build a new car that retained the heritage of Electra while incorporating aerodynamic design and the latest technology such as front-wheel drive, there was another, equally strong commitment. The new Electra would still be an Electra. The idea of an Electra would be honored. There would be high style and high technology, but there would be the luxury, comfort and that special attention to quality and detail that had always set the Electra apart in the minds of discriminating people.

Aerodynamics, the science of air management, is worked out in General Motors giant wind tunnel.

An idea that will become a new Buick begins to take shape.

At about the same time, the concept for the front-wheel-drive Somerset Regal began to take shape. But unlike the new Electra, which would be an all-new execution of a traditional theme, the Somerset Regal would create its own theme which would be a new concept—a blend of sports and luxury presented in an all-new style and an all-new size. It would be a unique amalgam of the virtues of European sports touring cars with traditional Buick values.

The bottom line: two decidedly different Buicks designed for distinctly different niches in the market, but the path they would follow from idea to reality would be, with minor nuances, the same. More on that later.

Almost as soon as a central, cohesive concept is established, it is torn apart and the various pieces handed over to specialists throughout the company. Engineers, stylists, interior designers, manufacturing specialists and product planners go to work on their piece of a puzzle that will take more than four years to put together.

Stylists, it would seem, are the least restricted at this stage, blessed as they are with the luxury of a clean piece of paper as a starting point. But they must work within carefully established parameters of overall size and weight; they must pay close attention to aerodynamics and must keep in mind that all-important position in the marketplace the new car will occupy. And there is constant interaction with other teams working on the new car. Each has to know what the other is doing and sometimes modify what they do accordingly.

Handmade clay models give the designer's illustrations dimension and form.

The stylists, for example, may come up with a front-end treatment they consider the perfect answer, only to learn from the engineers that it doesn't permit sufficient cooling air for the engine. The suspension engineers may need more room inside a fender to fit the new suspension they are developing.

Work with models in the General Motors wind tunnel at the GM Tech Center in Warren, Michigan, begins early in the design program. It will dictate changes, some subtle, some dramatic. The wind tunnel, for example, dictated the subtlety of making the chrome trim inside the Somerset Regal's wheel arches flush with the body work, but also dictated the dramatic shape of the air scoop under the Electra's nose.

In addition to all the information and direction generated inside, the devel-

opment teams are fed information from the outside, the world of the customer. The idea, after all, is to build a car customers will like; and in order to find out what customers like, Buick asks them. At various times during the development of a new car, clinics are held around the country. From potential customers we learn if the car meets expectations, if it is

Computer Aided Design (CAD) enables concepts and theories to be analyzed and refined electronically.

going to be what the consumer wants. Buick calls it listening and reacting.

With the shape of a car determined, the actual structure can be developed. Traditionally, that meant the time-consuming process of making scale and full-size parts by hand, testing them and then doing it all over again. The process was streamlined a few years ago with the introduction of finite element modeling, also called computer aided design (CAD), that enabled engineers to refine designs on the computer before experimental parts were made.

The Electra and Somerset Regal were the first Buicks to benefit from an additional computer technique called structural scale modeling in which scale and full-size models were made of plastic and tested—some were even barrier crash tested—to verify their design. This technique not only reduced the time necessary to reach final design stages, it resulted in a lighter, and even stronger structure.

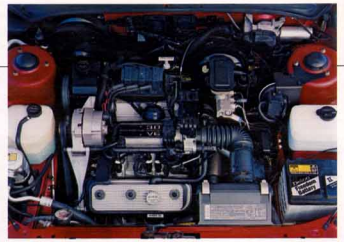
The selection and development of the proper powertrain is certainly critical to the success of a new car. Again, the choice is governed by the role the car will play in the marketplace. Although the Electra concept called for a weight reduction of 600 pounds and a reduction in overall length of two feet, it would still be the flagship Buick with comfortable room for six and plenty of luggage capacity. Just a few years ago that kind of package would have mandated V-8 power, but

Plastic scale models—this is the front of the new Electra—are used to evaluate designs. Some are even barrier tested.

now that kind of performance can be provided by V-6 engines which can also be neatly adapted to front-wheel drive.

The engine development group began work on 3.0 litre and 3.8 litre V-6

Electra's transverse engine arrangement allows better passenger accommodation in a smaller package.



The 3.0 litre V-6 with MFI in the Somerset Regal has been "styled" for appearance and easy access.

engines that would make use of the latest advancements in the computer control of engine functions. Both engines would work through a new four-speed overdrive automatic transaxle, also computer controlled, that was being developed by yet another group. They would also use multi-port fuel injection, developed in conjunction with Bosch of Stuttgart, Germany. More on that in a moment.

The sporty aspect of the Somerset Regal called for a lively four-cylinder engine and five-speed manual transmission, a combination that propels the new car with definite authority. It was also anticipated that some owners would want the smoothness and added horsepower of a V-6. But to make the 3.0 litre V-6 fit without changing the aerodynamics and the design esthetics of the Somerset Regal's sloping nose, the engine had to be dramatically reduced in height, which meant another involved development program.

A suspension system must suit the car; and in the case of the Somerset Regal, it had to reflect the car's sporty character. But it also had to provide those special ride characteristics that are such a part of what makes a Buick a Buick. That meant carefully designing and then tuning the Somerset Regal's suspension—MacPherson struts in front, coil springs in back—for the kind of lateral stability and road-holding a sport coupe must have, but without sacrificing ride comfort. Not an easy assignment, but it was accomplished.

At the same time, figuratively across the room at the suspension lab, another team was developing the suspension for the Electra. The front elements would be conceptually similar to those on other front-wheel-drive Buicks, but an all-new independent system was called for at the rear. Structural scale modeling was also used in the development of the rear suspension and, as we shall see later, the results were quite remarkable.

Testing is the common thread running through all the many and varied programs that go into the development, the creation of a new Buick. Test, test and test again; first in the lab, then on the track, then out in the real world where cars live. When the lab testing of individual components has gone as far as it can go, those components are brought together, to work in concert for the first time, in a prototype car that is driven, hard, around the test track for days on end. Then it goes into the real world, to places such as Death Valley, Pikes Peak and New York City. And, with the Electra, Europe and Australia. If any part of the system isn't up to the challenge, back it goes for further development until it is.

Finally, when everything is judged to be up to the challenge, it's ready to become a production car—almost. First, prototype parts are turned into pre-production parts which are put together on a "pilot assembly line" to make sure everything will go together as planned. Then personnel are trained to build the new car. But finally one day it really does end. No more planning, designing, developing, testing, prototyping, testing some more. It is finished. Production begins. In the case of the Electra, 210 weeks after The Idea, the car was ready for the ultimate test—the consumer.

It is a long, grueling process, but that is what it takes to create a new Buick.

An Electra prototype was subjected to thousands of punishing miles in the heat and dust of the Australian Outback.

Nowhere is the revolution in automotive engineering and technology more evident than under the hood. What used to be a relatively simple device with pistons and a straight-forward carburetor has become a piece of technology so advanced it has to be controlled by the latest in electronic and computer science. But don't think things have only gotten more complicated. Today's engines work better in all respects than their more simple forebears.

Buick has long been an acknowledged leader in the development and science of V-6 engines. An example of that leadership is the 3.8 V-6 with MFI, which is standard equipment on the Park Avenue. MFI stands for multi-port fuel injection, a precise method of delivering fuel individually to each cylinder which results in responsive performance, driveability and good fuel economy (refer to the EPA mileage estimates and engine supplement chart included with this catalog). For some very specialized expertise we went to Bosch of Germany, which for years has enjoyed a reputation as a leader in the development of electronic fuel injection systems. Working together with Bosch, the Buick system was designed and perfected here, then confirmed on the wide-open German Autobahn.

A 3.8 litre V-6 with MFI, standard in the Park Avenue, uses multi-port fuel injection for precise delivery of fuel.

The MFI system replaces the typical carburetor with six Bosch fuel injectors located just ahead of the intake port for each cylinder. The injectors are mounted on a pressurized fuel rail and are activated simultaneously, once each engine revolution (twice per power cycle), on signal from the on-board computer called the Electronic Control Module or ECM. These days, with computers as common as microwave ovens, there is a tendency to be a bit blasé about them and their remarkable abilities. That is, until you consider what goes on in the 3.8 MFI's computer.

The ECM's basic assignment is to monitor engine operations and environmental conditions and then,

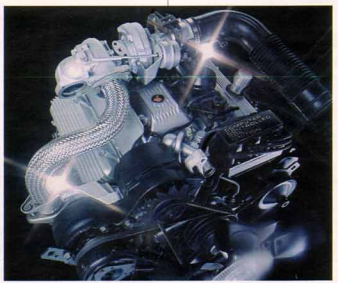
The Electronic Control Module (ECM) assures correct air/fuel mixture, ignition timing and idle speed.

based on that information, be sure the engine gets the correct air/fuel mixture, ignition timing and idle speed. The ECM gets its information from an oxygen sensor in the exhaust, a sensor in the engine cooling system, a detonation sensor, a hot film mass air-flow sensor (more on that in a moment) and a throttle position sensor. There's more. It also gets information on engine RPM, the speed of the vehicle, the gear the transmission is in, the demands on the power steering system and what the air conditioner is doing. At the rate of up to 80 times every second the ECM analyzes and compares all this information and then sends a signal to the fuel injection system telling it exactly when and for how long to inject fuel. And, since the air/fuel mixture is of no use unless ignited at the precisely proper moment, the ECM also controls ignition timing.

With multi-port fuel injection, electronically controlled injectors deliver a precise shot of fuel into each intake port.

The mass air-flow sensor provides an on-board computer with information critical to maintaining proper air-fuel mixture.

The mass air-flow sensor developed by Buick and the AC/Delco Division of General Motors accurately measures not only the volume of air flowing into the engine—a common practice in electronic fuel injection systems—but, by using a piece of heated film and electronically noting changes in voltage necessary to maintain a desired temperature of the incoming air, it measures the mass of the flow as well. That information is critical in maintaining the proper air/fuel mixture. This heated film techique is a Buick developmental exclusive, and unique in the automotive world.

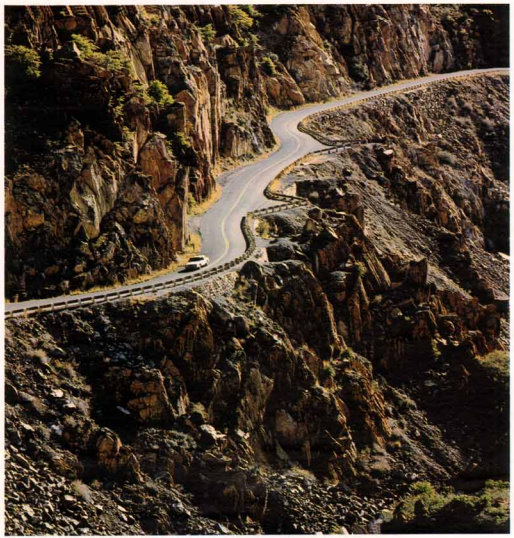


The 3.8 litre turbocharged V-6 with sequential-port fuel injection, or SFI: state-of-the-art engine technology that produces 200 horsepower.

There are some very tangible owner benefits from all this electronic wizardry. Fuel efficiency is maintained, cold starting problems are virtually eliminated, and overall driveability is noticeably smooth and pleasant. The engine can go from the depths of Death Valley to the top of Pikes Peak with no adjustments other than those it continually makes for itself. (Speaking of Pikes Peak, that very trip is a regular part of Buick's road testing program.) With 125 horsepower and 195 pounds-feet of torque, the 3.8 MFI can accelerate the Electra with the kind of performance that used to be the exclusive realm of heavier and thirstier V-8s. And, the engine was given a dressed-up look by routing wires and hoses out of sight and "styling" the intake manifold and rocker covers. A styled engine compartment not only looked attractive, it would be orderly and easy to understand for the mechanic.

The performance of the 3.8 MFI is impressive, to be sure; but there is even more performance available from the turbocharged version: the 3.8 Turbo with SFI, which is available on the Regal and Riviera T Types and the Regal Grand National. Several years ago Buick decided to explore every avenue of engine technology that rapid advances in electronic control systems were opening up. Turbocharging was one of those avenues. Buick startled the industry and delighted enthusiasts with the introduction of a turbocharged V-6 option for the 1978 Regal. Buick has since become a *world* leader in the manufacture of turbocharged production cars.

Ongoing development and refinement of the turbocharging concept has led to the 1985 3.8 Turbo with sequential-port fuel injection, a fully integrated, computer-controlled powerplant system.



Electronic systems insure optimum engine performance under all driving conditions, from desert to mountaintop, from winter to summer.

Turbocharged performance is the theme of the Regal Grand National.

Turbocharging uses an engine's exhaust gas to spin a turbine at very high speed which in turn forces a concentrated charge of fuel and

With sequential-port fuel injection, fuel is metered directly into each combustion chamber.

air into the engine. This concentrated charge ignites with a force far greater than that generated by a fuel/air mixture pushed into the cylinders by atmospheric pressure, and that means more horsepower. Sounds simple, but it's really quite sophisticated, and calls for extremely precise control of all engine functions.

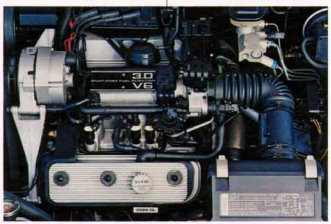
The turbo engine employs essentially the same monitoring and control systems used on the regular 3.8 MFI engine with some important additions. SFI stands for sequential-port fuel injection. With SFI, controlled by the on-board computer, each cylinder receives one precisely metered injection of fuel just prior to the opening of the intake valve. This precision is necessary to ensure proper performance through the engine's extremely wide range of

C³I, computer controlled coil ignition, replaces the distributor and coil used on most engines.

operating conditions, from idle to cruise to full power.

The 3.8 Turbo with SFI also benefits from another example of advanced Buick electronic technology called the computer controlled coil ignition, or C³I for short. The C³I replaces the distributor used on most engines with a microprocessor that receives signals from the crankshaft and camshaft and then distributes high-voltage current to the spark plugs at exactly the right time and for exactly the right duration.

Before getting the turbo treatment, the 3.8 litre V-6 with multi-port fuel injection produces 125 horsepower and 195 pounds-feet of torque. Turbocharging increases those figures substantially to 200 horsepower and 300 pounds-feet. On the test track the Regal T Type has been clocked from 0 to 60 mph in less than eight seconds, making it one of



The 3.0 MFI V-6 in the new Somerset Regal is one of the most aesthetically pleasing engine packages on the road today.

the quickest production coupes in the world.

That same kind of pulse-quickening excitement can also be found in a special version of Buick's smallest car, the Skyhawk. Turbocharging the Skyhawk's 1.8 litre four-cylinder engine pushes the horsepower to 150, an increase of 78%, and on the track that translates into a 0-60 time of 8.5 seconds. As they say in the car magazines, the Skyhawk turbo is a screamer.

A 1.8 litre overhead cam four is available on Skyhawk. Stunning performance in a small package.

The available engine on the new Somerset Regal, the 3.0 MFI, is a sophisticated version of the 3.0 litre V-6. This engine uses the multi-port fuel injection system and the hot film mass airflow sensor used on the 3.8 MFI and the C³I ignition used on the turbo engine.

Buick engineers also came up with a clever new oil pump design for the 3.0 MFI. The oil pump is a gear within a gear driven by the crankshaft. As the gears turn, the area between them increases in size for half a revolution, creating a vacuum that pulls oil into the pump. During the second half of the rotation, the area decreases in size, which pressurizes the oil and pumps it through the engine. It is lighter, uses less engine power and is more efficient than traditional pumps.

To fit under the Somerset's aerodynamic hood, the height of the engine was reduced significantly and, in keeping with Buick's philosophy that every element of the car should reflect the best in design and quality, the engine compartment was given a new look: wires and hoses were carefully routed out of sight, dip sticks for crankcase and transmission fluid were labeled and repositioned for easy access, and the air cleaner moved from on top of the engine to the left-front corner. Neat, tidy, and quite handsome.

While the latest developments in V-6 technology—the 3.8 MFI, the 3.8 SFI and 3.0 MFI—may be the stars of this year's show, Buick offers a suit-any-purpose range of engines from economical fours and diesels to a smooth, quiet V-8. And there is an

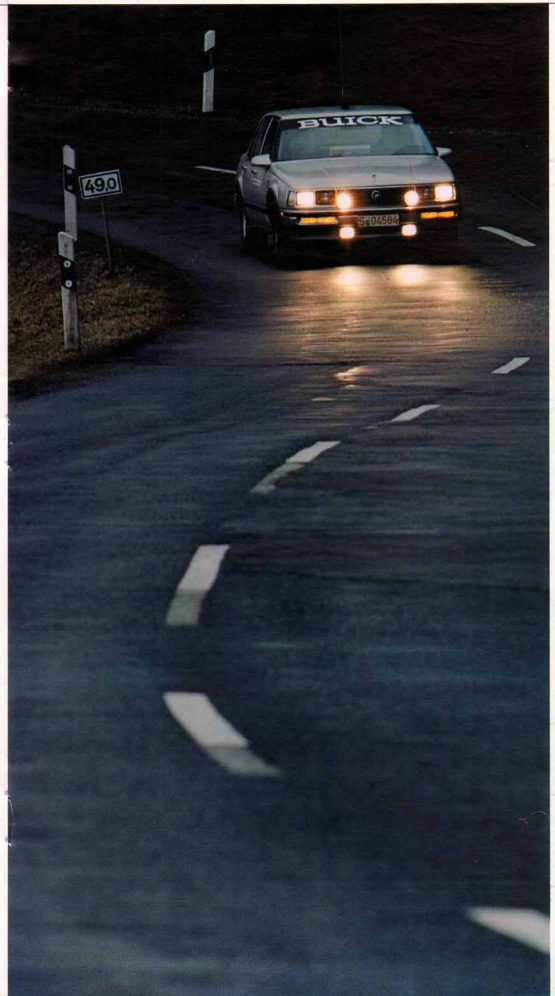
A new four-speed automatic transmission with overdrive is computer-controlled.

equally wide selection of transmissions to go with them: four- and five-speed manuals, a three-speed automatic and the all-new, computer controlled four-speed automatic with overdrive that is standard on all Electra coupes and sedans and deserves special mention.

This remarkable new four-speed automatic transmission has a converter clutch which engages, on command from the ECM, in third and fourth gears to eliminate torque converter slippage. The ECM can distinguish between a cold and warm engine, various road speeds, grades and other conditions. It then makes its decision to engage or disengage the clutch based on that information.

Clearly the technological revolution has come to engines—and transmissions—and Buick is, as usual, at the forefront.

An Electra test mule at speed in the German Alps.



Webster's New Collegiate Dictionary defines suspension as "the system of devices (such as springs) supporting the upper part of a vehicle on the axles." Exactly. Short, to the point, and most accurate. But there's a bit more to the suspension system of a Buick than that.

The suspension system is the magic ingredient. It, more than anything else, determines a car's personality: from brashly sporty to comfortably luxurious. Of course, interior trim, instrument panels, and seat design all play a part; but those things are reinforcements of the message you get through the seat of your pants, a message coming to you courtesy of the suspension.

The suspension has to match the mission; and the suspension of every Buick is developed with a specific mission in mind. The new Electra's mission was well understood when suspension design and development began on it in 1981. The new Electra would be different, but it would, first and foremost, be an *Electra* and true to its heritage.

Suspension systems are carefully designed to match each Buick's mission.

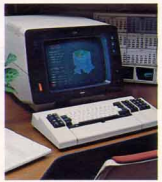
But at Buick, "new" automatically means "improved," as you will discover. The suspension designers and engineers were told to create a suspension system that would give the Electra impressive handling characteristics, but most importantly, without compromising the

Electra's traditionally supple luxury car ride. A tall order, but one that absolutely *had* to be filled.

In recent years computers have played an ever-increasing role in almost every aspect of new-car design. Before today's generation of sophisticated computers, the traditional approach had been to pro-

Electra, surefooted and poised, under tough driving conditions.

duce experimental components for evaluation, then redesign and refine them until you had a final product. With the advent of a computer-based finite element modeling it became possible to literally design and refine on the computer's monitor before experimental models are produced. It's an analytical as opposed to an experimental approach that



In finite element modeling, a computer is used to analyze specific design concepts.

is faster, less expensive and much more efficient.

For the new Electra, Buick took the analytical approach one step further. Using a technique known as structural scale modeling the

Space-saving MacPherson struts and concentric coil springs are used in the Electra's front suspension.

engineers were able to build from 3/8 scale to full-size structurally-representative body and suspension components out of plastic in a matter of hours. These components were then tested to verify their design. The "turnaround time" was reduced by more than 50 percent; structural integrity

Structural scale modeling has led to lighter, stronger Buicks.

was improved and weight was reduced.

An early decision regarding the Electra's suspension dictated it be fully independent, front and rear. MacPherson struts were chosen for the front suspension. Several variations were considered for the rear with the final nod going to a new design that combines an independent strut with an inboard coil spring. This "coil strut" design improves ride comfort by dispersing road inputs into the body through separate routes. The system is adjustable for both camber and toe-in which means the rear suspension can be fine tuned for the best performance possible. The ride smoothness for which Buick is so well known used to come at the expense of ride control, but no longer. The Electra's suspension has a high level of lateral stiffness for precise control in cornering, but still delivers traditional Electra ride comfort.

The T Type's suspension is ready to meet the challenge of a winding road.

Another aspect of the Electra's newly designed rear suspension is an automatic leveling system. When it senses a prolonged increase in the load, it activates a compressor which pumps up the rear struts to proper ride height.

There's an Electra with a mission decidedly unlike other Electras: The Electra T Type. Like all the other T Types in the Buick family—Skyhawk, Regal, Century and Riviera—the Electra T Type is built for the enthusiast driver who is looking for a more "European" driving experience. And the Electra T Type is a perfect example of how a suspension system plays a key role in the development of a car's personality.

The Electra T Type uses the same suspension that gives the other Electras their traditional ride quality; but in this application the springs and struts were stiffened, the diameter of the anti-roll bars increased and, to round out the package, the rack-and-pinion steering ratio was quickened. Simple enough, but the results are dramatic. Taut, firm, extremely flat in the turns—what a personality change. There's never been an Electra quite like the T Type.

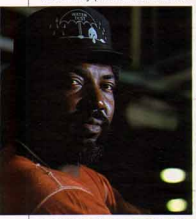
While they are not technically suspension components, wheels, tires and brakes nonetheless play an important part in the way a car rides and handles. Buick engineers work closely with tire manufacturers to get the optimum tire for every application, and wheels are designed to fit specific suspension and brake packages. Ventilated front disc brakes are standard equipment on every Buick.

Suspension systems are the "magic ingredient," and Buick has the magic down to a science.

The end product: a better product.

Team spirit at work.

In Wentzville, Missouri, one of the largest automobile assembly plants in the world is building the new Electra. Buicks are built at other locations around the country; but the Wentzville Assembly Center, in addition to its record-breaking size, is so state-of-the-art, so filled with the high-technology assembly devices and processes, and the work force so embued with the philosophy of quality, it deserves a special mention in this Buick story.



There is a special pride on the line at Wentzville. Just ask this member of the "Water Leak" team.

Under an 85-acre roof is an assembly process that makes use of the latest in computer and robotic technology.

But despite all the robots and computers, it always comes down to people, the *people* who make Buicks.

No one is more committed to quality than Buick; but unlike some manufacturers, Buick has assiduously avoided selling assembly-line workers on the merits of high quality with meaningless sloganeering. Rather, Buick and the assembly line operators have adopted a simple philosophy. Call it "operator responsible" if it needs a name. Understanding the value of producing quality products for consumers who demand quality more now than ever before, each assembly line worker takes total responsibility for the work he performs. *He's his own quality checker.* In effect, every operator on the line is an inspector.

Using a hand-held computer called a Data-Mite, an inspector makes a record of his detailed quality checks on the assembly line.

"Everybody has a customer for his service," one supervisor explains. "For the operator on the line, it is the next operator on the line." And as if to underscore that, a sign on a well-used toolbox reads, "Pass on only perfect work. You have to keep the customer satisfied."

Certainly there are official quality-control checks throughout the assembly process. A new system called Statistical Process Control monitors the assembly process and catches even subtle deviations before they can become problems. But the system no longer accepts poor quality on the line, knowing it will be fixed somewhere around the corner and out of sight.

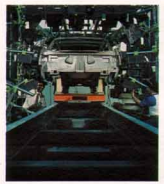
"You don't repair quality back in," a worker explains. "You do it right the first time." (An example of this desire to do it right the first time is the Mutual Awareness Program (MAP) in which employes meet on their own time, to discuss quality in their areas of responsibility.) The demand for quality extends beyond the Assembly Center's doors. Outside suppliers are operating under the same stringent demands the Center has set for itself. Poor quality parts will not be tolerated.

Electra bodies move through the robotic welding system on a computer-controlled monorail.

Quality, of course, is the chief motive behind the implementation of the latest in robotics at Wentzville. Robots tirelessly perform the same tedious task the same way every time. No variations. Only precision work, done to tighter tolerances, with higher consistency, time after time after time.

Management and line workers meet regularly to iron out production problems.

At Wentzville, there are 137 robots in the body shop, another 18 in the main paint booth, all computer controlled. Robots precisely apply some 2500 welds to each body, which is more than 90 percent of *all* welding done during the assembly process. The various body pieces move through the assembly process, collectively looking more and more like a car as they pass from one station to the next. The continuously moving assembly line has been eliminated in favor of a stop-and-go line. Body parts are transferred on an automated monorail system, from one station to another, fixed into place and then welded. This stop-and-go method means the automatic welders don't have to hit a "moving target."



Technicians program Perceptron for laser beam inspection of new Buicks.

In preparation for painting, the bare metal body is submerged in a phosphate cleaning solution, then submerged in another tank for what is known as "cathodic electrodeposition" of primer – giving the body and the primer opposite electrical charges, so the primer is attracted to, and bonds thoroughly with, the oppositely charged body. Then, after some time in the drying oven, all the joints on the primered body are carefully sealed for anti-corrosion protection. Next, primer/surfacer is applied and baked. And then, in a dramatic departure from the high-technology processes applied before, the body is wet-sanded *by hand* to provide a perfect surface for

The Electra's bare metal body and primer are given opposite electrical charges making the primer solidly adhere to every surface

Finally, the main subassemblies come together at a huge automated machine, two stories high and 100 feet long, called the robogate framer, which completes the welding of the Electra's unibody with a dimensional accuracy of plus or minus 1mm (0.04 inch).

At another station a very specialized, and unique in the industry, robot uses television cameras and lasers to precisely measure, compute and weld critical, high visibility joints with a silicon bronze material.

This device, with the imposing name of *Perceptron*, uses 120 cameras and lasers to check all openings in the body to insure they are dimensionally correct.

Careful hand sanding meticulously prepares every Electra body for painting.

Robots apply two coats of body color, followed by two coats of clear acrylic enamel.

the paint. The result is a smoother finish and a higher-quality look overall.

In the paint booth a battery of robots do their computerized ballet around the body, opening doors and

The Data-Mite hand-held computer is also used in the visual inspection of the finished paint job.

spraying inside surfaces, closing doors and spraying outside surfaces. Two coats of enamel color are followed by two coats of clear acrylic enamel. The result is a deep, lustrous finish that is long-lasting and virtually maintenance free.

The painted body is fitted with its suspension, engine and transmission and moves to the final assembly area where all the interior com-

Instrument panel installation.

ponents are carefully installed by hand. This is the labor-intensive part of the assembly process, and this is where the individual operator's commitment to quality pays off. But here, as at every other step along the way, modern technology lends a hand. Driverless fork-lift trucks, silent except for an electronic beeping to warn of their coming, follow wires implanted in the assembly center's floor

In the check for water leaks, a pressurized water and dye mixture is sprayed on at a simulated 40 mph. A "black light" instrument, which makes the dye visible, indicates any leaks.

to deliver bins of parts to the work stations. It's part of the *"just in time"* method of parts inventory. With this system, only the bare minimum of parts is kept on hand. Supplies arrive just in time to be used. The backlog of parts is intended to be no more than a few hours' worth. This means less money tied up in inventories of parts and supplies; but just as importantly, it forces outside suppliers to reduce defects since there

An engine and chassis are "married."

Seats are expertly, carefully upholstered by hand.

A driverless "Towveyor" follows an electrical cable buried in the floor to efficiently deliver parts to work stations throughout the assembly area.

Modern assembly techniques and dedication to quality help produce the best Buicks ever.

Each Electra gets a thorough final inspection at the end of the line.

are no stockpiles to draw from if a bad shipment pulls in.

At the end of the assembly process the electrical and mechanical systems are thoroughly checked, and the car is given a complete visual inspection in a final assault on the smallest violations of quality standards. The Electra that rolls out into the Missouri sunshine, armed with the very latest in manufacturing techniques and backed by an employe commitment to quality, is as good as Buick can make it.

It is a shame to treat a nice car like Century this way, but we do. Over and over and over.

How would you like to spend months, sometimes years, working to get something right, and then, just when you think you've done it, have to hand it over to a group of people whose only

Buicks come back from barrier testing a little the worse for wear.

assignment is to do everything they can to break it?

That, essentially, is what testing is all about: make something as good as you can, test it until it breaks, make it better, test it until it breaks again and keep going like that until it won't break, or until what it takes to break it is way out there on the other side of reasonableness. From that kind of philosophy comes Buick's well-deserved reputation for dependability.

Everyone is familiar with the typical photographs of a car undergoing track testing: bouncing over cobblestones the size of second base, splashing through a water trough, weaving in and out of pylons. Those tests are important in the development of a new car or the refinement of existing systems; but before a prototype of a new car ever sets tire

The pylons help refine maneuverability.

to test track, hours and in some cases *years* of testing have already taken place.

The testing program for a new engine will typically call for some 600 hours on the dynamometer where it is run at wide-open throttle; first at peak torque, then at peak horsepower, then back to peak torque and so on. The internal stresses are phenomenal. The test simulates approximately 300,000 of the toughest owner miles imaginable.

In a cam-wear test the load on the valve springs is doubled from normal, and the engine run for 800 hours. There's a dirt injection test for oil pumps (some owners are a bit lax when it comes to regular oil changes), so a Buick oil pump has to be able to handle some pretty grim stuff.

To test connecting rods, an engine is run at high speed (6000 rpm) with no

Test engines are run hundreds of hours wide-open on the dynamometer.

load until a rod fails, or until it refuses to fail.

Then, when all the various parts seem to be up to their assigned tasks, an engine will be installed in a car and run on the test track at high speed, in the 90 to 110 mph range, for 10,000 to 20,000 miles.

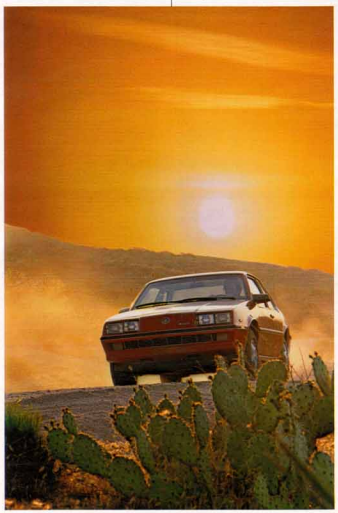
An engine testing program can take a year and a half to complete, and it's not unusual for testing of various components to begin more than two years in advance of production.

Hot weather testing in the Australian Outback.

Suspension systems also undergo strenuous durability testing. Each component goes through a destructive cycling test; then the individual components are assembled and 100,000 customer miles are simulated in the laboratory. That completed, the suspension is mounted in a vehicle and track testing begins.

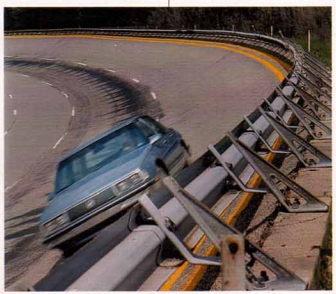
One suspension durability test conducted at the proving grounds is so rugged it duplicates 75,000 hard owner miles in just 9,000 track miles. And there is particular emphasis on corrosion resistance. No other part of a Buick is exposed to such concentrated attack by corrosive factors as its suspension. Buick uses the latest in anti-corrosion fighters to protect vital suspension parts, then tests and re-tests to assure those parts will survive. One test is so intense that in as few as 60,000 miles it duplicates 10 years of owner use in the most corrosive environment imaginable.

There's more. Transmissions are cycled through 60,000 or more shifting cycles. Windshield wipers literally travel miles across windshields; power windows open and close thousands of times; switches are turned on and off until they fail, are improved and go through it all again.



Buicks are tested in all types of severe climates, everywhere Buicks have to live.

When engines and transmissions and suspensions and all the rest are ready, prototype cars are built around them and sent out into the world. They are driven in all kinds of weather, on all kinds of roads, in all kinds of climates. And in the case of the new Electra, the real-world testing was taken to extremes.



Sustained high-speed testing is also done on the test track.

A pre-production test "mule" was taken to Germany where final confirmation work on the fuel injection was completed at Bosch, in Stuttgart. In the process, the car was subjected to a full measure of twisty Alpine highways and no-speed-limit Autobahn. (More than a few drivers of German sports sedans were surprised when an Electra whistled past them in the fast lane, but that's another story.) To keep the rigorous hot weather test program going when winter had closed in on most of the U.S., another test mule was shipped to Australia to endure 108° F heat, choking dust and the punishing roads of the Outback. And then there was some −40° F weather in Canada, just for good measure.

The rapid proliferation of electronics in automobiles has posed some interesting testing requirements for Buick engineers, requirements that didn't exist back when things were a bit more simple. Not only must the electronic system in a Buick contend with and be immune to a wide range of temperature and climatic conditions, it must be immune to the constant barrage of electronic interference being generated by everything from television signals to microwave ovens. To that end, General Motors has constructed a specially designed test facility called the electro-magnetic compatability chamber where the electronic systems so vital to the functioning of an automobile are subjected to interference of almost every kind. An electronics system that passes that kind of testing can be counted on to perform accurately and dependably.

Testing is an expensive, time-consuming process with but one goal in mind: to make every Buick live up to its name.

The Electra's passing ability was tested on the no-speed-limit German Autobahn.

The Buick interior.

The Buick experience is enjoyed most in one particular location: inside a Buick.

All the mechanical wonders of modern technology cannot produce interior environment that is comfortable, attractive, efficient and, above all, luxurious. That is something that calls for the human touch. Buick understands this basic tenet and has spared no effort in creating an interior environment in each of its cars equal to the style and quality surrounding it.

Electra window controls have new "High-Low" button design.

Electronic digital instrumentation is standard on the Somerset Regal.

The key to a successful automobile interior is the application of human engineering, or "ergonomics," which has to do, simply stated, with putting things where they can be seen, reached and used in the most efficient manner. It means such things as designing steering wheels so the spokes don't hide instruments, making those instruments easy to read in all lighting conditions, locating most-used controls within easy, unobstructed reach, and so on. Little things mean a lot.

Some examples of good—even innovative—ergonomic design can be found in the new Electra and Somerset Regal. The standard power-window controls in the Electra are located on the armrest just inches from the driver's left hand, which is good. But even better, to eliminate any confusion, to make sure the driver doesn't have to take his eyes off the road, the rocker switches for the windows have a "bump" on one end to indicate *Up* and a fingertip size depression on the other end to indicate *Down*.

The Somerset Regal, by virtue of being the newest member of the Buick family, has benefitted from some of the latest concepts in cockpit design. Frequently-used controls are located in a pod within fingertip reach of the steering wheel and are activated with new low-travel switches. The travel is only about a tenth of an inch and the feel is truly high-tech, or "soft-touch" as the designers call it. Electronic digital instrumentation is standard on all Somerset Regals, and is designed to provide maximum information quickly and easily. Buick made a significant step in instrumentation technology with the Multi-gage, an instrument in the cluster which will give, on command, readouts for voltmeter, oil pressure, engine temperature and tachometer.

Remote location of radio controls in Somerset Regal makes operation quick and easy.

An unusual neutral density filter over the instruments is, Buick feels, the best compromise between maximum visibility in all lighting conditions and freedom from glare.

The control head for the radio in the Somerset Regal is located at the top of the center console, also just inches from the driver's hand, where it can be seen easily. Ergonomics at work.

Most Buicks have a multi-function stalk on the steering column that puts frequently used switches, such as those for turn signals, headlamp dimmer and cruise control, at the driver's fingertips.

A good driving position is an important part of an ergonomically successful interior, but simply putting a comfortable seat behind a steering wheel is no guarantee of a good driving position. Drivers come in all sizes, so we design seating positions that are right for most people. Seat height is carefully determined, and there must be sufficient fore and aft travel to suit the extremes and the in-betweens. Seatback angle is determined in concert with the angle and height of the steering wheel. (Reclining seatbacks are now standard on all Buick bucket seats.) The result is a proper driving position that is only a couple of adjustments away. And that is without the added versatility of options such as power seats or tilt steering.

Seat design itself has lately undergone some new-think. The trend is definitely away from sofa-like softness toward more firm support. Buick seats are constructed with a special dual-density foam that provides firm support but still has good cushioning properties. And shapes are changing. Seats are sprouting bolsters and mini-wings for much improved thigh, lumbar and lateral support. The front buckets in the new Somerset are a perfect example of the latest thinking in seat design and construction.

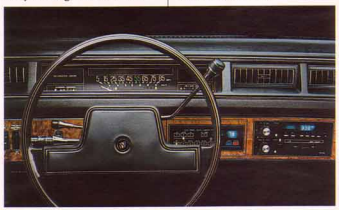
Sporty Lear Siegler bucket seats are available in some Buick models. These seats provide rather dramatic adjustments for seatback recline and for lateral and lumbar support, and are definitely intended for enthusiastic driving.

Buick and Delco Electronics have jointly developed a new Electronic Touch Climate Control for use in the 1985 Electra. In this system, levers, switches, knobs and thumb wheels have been replaced by touch-sensitive switches. Touch "warm" or "cool" to change the temperature in one-degree increments displayed on a digital readout. Another touch shows outside temperature. Touch to set fan speed or turn on the defoggers. Each touch is confirmed by an audible beep. The heart of the system is an 8-bit microprocessor with 112 bytes of RAM and 3700 bytes of ROM.

Also available for the Electra is an interesting bit of electronic helpfulness called a keyless entry system. Pressing any switch activates the illuminated entry system. Entering the correct five-digit code unlocks the driver's door. Another touch unlocks all doors, another touch unlocks the trunk.

Seats, too, have entered the computer age. With Electra's optional memory seat, two drivers can program their favorite seating position, and with a touch of a button the seat will remember and automatically re-adjust.

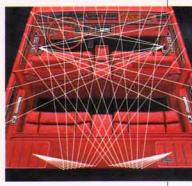
Reclining seatbacks, standard with all Buick bucket seats, make a comfortable seating position just an adjustment away.



The Electra's instrument panel is as handsome as it is functional.

The Electra's optional "memory" seat remembers two pre-set positions.

Electronically tuned Delco AM-FM stereo radios and cassette decks are available throughout the Buick line, with the Delco GM/Bose Music System available on certain models. The Delco GM/Bose system tailors sound to the acoustics of the specific car in which it is installed, and delivers 50 watts of power per channel, instead of the eight to ten watts per channel in a typical car sound system.



The Delco GM/Bose Music System tailors the sound for the specific acoustics of the car.

The little things really do mean a lot. Little things such as the visor map holder and the remote fuel door release on the Somerset Regal and the translucent sun shade on the Park Avenue may not seem terribly important, especially in light of the many electronic marvels found on every Buick, but they are thoughtful touches, those little something extras that tell you Buick cares.

Inside every Buick is a carefully designed environment for driver and passengers.

The Buick Electronic Product Information Center (EPIC) helps take the confusion out of new-car shopping.

It should be no secret by now that we want you to buy a Buick. But there is something more. We want you to enjoy *buying* your Buick as much as you will owning it. We call it the *Buick experience*, and it begins the moment you begin to shop.

Let's face it. Buying a new car can be something less than the pleasurable experience it should be. Too often the process is fraught with anxiety, tension and, especially, confusion. Which model to buy? How does it stack up to the competition? What equipment is standard? What equipment is available at extra cost? If I get this do I have to take that? And on and on. Sometimes a buyer wants to say, "Enough. I'll take the beige one," just to get it over with. That is no fun.

The solution is information, information that is easy to get, and easy to understand. That is where EPIC comes in.

EPIC stands for Electronic Product Information Center, a computer information terminal now in selected Buick dealerships and planned for deployment throughout our dealer network. (There is also a plan for placing them in major airports and shopping malls across the country to make the information they contain even more accessible.) It is a complicated system that is simple to operate. Push a couple of buttons on EPIC's keyboard (it tells you which ones, so don't worry about that) and the screen will be filled with information on any Buick model. Push another button to see what standard equipment is offered; another push gives information on available equipment. And EPIC is prepared to give you the same facts and figures on competitive models for a no-holds-barred comparison. We think you have to know about *them* to make a decision about *us*. EPIC is even capable of searching through the dealership system to find specially equipped models.

For the first time, information that could only be collected with a trip to the library and wading through piles of car magazines and consumer guides, is available from one source, instantly. And, very importantly, you can avail yourself of EPIC's storehouse of information at your leisure. So long, confusion.

But as informative as a computer can be, it can never completely replace the main source of information and guidance in the showroom: the salesperson. We feel we have some of the very best; and we're constantly working with dealers to not only maintain their high degree of competency, but to improve on it. Knowledgeable, helpful sales people who are quick to understand your particular wants and needs are another important part of the Buick experience.

That experience continues when you take delivery of your new Buick. We know there's nothing quite like that first drive home: the feel of an unfamiliar steering wheel; a new view of the world over a long, lustrous hood; spotless upholstery (you make a resolution that this time you will keep it that way); the supple ride; the smell, especially the smell. And be honest: don't you sort of hope that just maybe a couple of the neighbors will be out when you drive up? Anyone who thinks the love affair with the automobile is over hasn't had a "first drive home" in too long a while.

But we also know that specialness is a tenuous thing. It can be gone in a minute if there is grease on the carpet, or the engine doesn't sound quite right, or the glove box door doesn't latch properly. Even a simple thing like a wayward screw rolling around on the floor can bring on fits of paranoia: *Where did it come from? What's about to fall off? New cars shouldn't have loose screws on the floor!*

Letter-Perfect Delivery helps insure your Buick is just that—letter perfect—when you take delivery.

Letter-Perfect Delivery was designed to assure the first drive home in your new Buick is everything it should be. Before you pick up the car it will have been thoroughly inspected not just once, but twice, and by different sets of critical eyes. The dealer representative will have a lengthy list of items to go over with you in a sort of "pre-flight" check-out, so you'll know where everything is and how it works. You will be briefed on the car's maintenance schedule; the provisions of the warranty will be explained; and, if you wish, you will be taken on a brief orientation ride to make certain everything is right before the keys are handed over. No grease spots, no funny noises under the hood. And no loose screws on the floor.

That first ride home is a very important part of the Buick experience. And so is quick and effective repair service. We start with a basic philosophy: fix it right the first time. To that end, Buick service technicians are continually exposed to the latest diagnostic and repair techniques. Today's automobiles are complex devices, and continual training is a must.

The computer technology we talked about earlier that is playing such an important part in the manufacturing process is also a key factor in the service department. Nothing will ever replace wrenches, screwdrivers and pliers on a technician's work table, but now they're sharing space with oscilloscopes and computer terminals. More and more, a technician is relying on these new tools to tell him how to better use those familiar old tools.

In each of Buick's 26 sales zones across the country, there's a mobile computer terminal called the Diagnostic Data Recorder (DDR). A service technician can attach the DDR to the on-board engine computer in any new Buick and get an immediate diagnosis of the problem. That's right. In some cases the computer not only analyzes symptoms, it identifies the problem.

Buick sales personnel are trained to understand a customer's needs and to make filling them a pleasant experience.

There's more. Who hasn't experienced the frustration of a mechanical problem that disappears as soon as the car enters the shop? End of frustration. The DDR can be installed in the car and the car driven by the technician until the problem reoccurs. The DDR stores the information for diagnosis back at the dealership.

If there is a particularly perplexing problem, the DDR can interface with a computer back at Buick headquarters in Flint, Michigan. There, perhaps hundreds of miles from your car, top factory technicians analyze the problem and recommend solutions. And the Technical Assistance Center in Flint is just an "800"-number call away from any technician.

The Diagnostic Data Recorder gives dealership technicians instant access to Buick factory technical personnel.

The Buick experience. It is as special as the car, and we are committed to keeping it that way. EPIC, well-trained sales and service people, Letter-Perfect Delivery, the DDR and easy access to the Technical Service Center are not just words and phrases. They are real, and they are proof we mean to keep that commitment.

Safety Equipment

Occupant protection.

Manual lap/shoulder belts for driver and right front passenger (driver side includes visual and audible warning system).

Manual lap belts at each rear seat position (and center front, when applicable).

Energy-absorbing steering column.

Passenger-guard inside door lock handles.

Safety interlocking door latches.

Safety armrests.

Inertia-locking, folding front seat backs.

Energy-absorbing instrument panel.

Energy-absorbing tops, front seats.

Safety strength seat attachments.

Smooth contoured door and window regulator handles.

Dual sun visors.

Laminated safety windshield glass and tempered safety side and rear window glass.

Head restraints, driver and right front passenger (adjustable/integral).

Pressure lock radiator cap.

Accident avoidance.

Side marker lights and reflectors.

Parking lamps that illuminate with headlamps.

Backup lights.

Windshield defroster, washer and dual-speed wipers.

Four-way hazard warning flasher.

Directional signal control and lane change feature.

Inside rearview mirror with vinyl-bonded glass.

Brake system with dual master cylinder and warning light.

Outside, left, rearview mirror (right also standard where applicable).

Starter safety switch.

Dual action hood latch system (except on Electra).

Low-glare finish on instrument panel top, inside windshield moldings, wiper arms/blades, metallic steering wheel surfaces.

Tires with built-in tread-wear indicators.

Audible brake lining wear indicators, all disc brakes.

Safety road wheel rims.

Self-adjusting brake feature.

Illuminated heater and defroster controls.

Illuminated windshield wiper and washer controls (if on instrument panel).

Pressure-relief fuel cap.

Anti-theft.

Audible reminder for ignition key removal.

Anti-theft steering column lock.

Remote inside hood release.

Anti-theft key system (separate key for ignition only).

Visible vehicle identification number.

"Let's get it together... buckle up."

Every new 1985 Buick delivered by a Buick dealer in the United States comes with a one year, $10,000 seat belt insurance certificate from MIC General Insurance Corporation at no additional charge. $10,000 will be paid to the estate of any occupant who suffers fatal injuries as a result of an accident involving that vehicle while wearing a GM seat belt. Buckle up every time you drive.

BUICK GM

Buy or lease a Buick.

Many Buick dealers offer you the opportunity to buy or lease a Buick. Ask about their leasing arrangement. It may be right for you.

The GM Protection Plan.

It offers service protection in addition to that provided by GM's new-vehicle limited warranty. Coverage is currently available only in U.S.A. and Canada for the 1985 model year. See your Buick dealer for details.

Important:
A word about this catalog.

We have tried to make this catalog as comprehensive and factual as possible and we hope you find it helpful. However, since the time of printing, some of the information you will find here may have been updated. Also, some of the equipment shown or described throughout this catalog is available at extra cost. Your dealer has details, and before ordering, you should ask him to bring you up to date.

The right is reserved to make changes at any time, without notice, in prices, colors, materials, equipment, specifications and models. Check with your Buick dealer for complete information.

A word about assembly, components and optional equipment in these Buick products.

The Buicks described in this catalog are assembled at facilities of General Motors Corporation operated by Buick or GM Assembly Division. These vehicles incorporate thousands of different components produced by various divisions of General Motors and by various suppliers to General Motors. From time to time during the manufacturing process, it may be necessary, in order to meet public demand for particular vehicles or equipment, or to meet federally mandated emissions, safety and fuel economy requirements, or for other reasons, to produce Buick products with differently sourced components than initially scheduled. All such components have been approved for use in Buick products and will provide the quality performance associated with the Buick name.

With respect to extra cost optional equipment, make certain you specify the type of equipment you desire on your vehicle when ordering it from your dealer. Some options may be unavailable when your car is built. Your dealer receives advice regarding current availability of options. You may ask the dealer for this information. GM also requests the dealer to advise you if an option you ordered is unavailable. We suggest that you verify that your car includes the optional equipment you ordered or if there are changes, that they are acceptable to you.

A word about updated service information.

Buick regularly sends its dealers useful service bulletins about Buick products. Buick monitors product performance in the field. We then prepare bulletins for servicing our products better. Now you can get these bulletins too. Ask your dealer. To get ordering information, call toll free 1 (800) 551-4123.

A word about engines.

Some Buicks are equipped with engines produced by other GM divisions, subsidiaries or affiliated companies worldwide. See your dealer for details or please refer to the Buick powerteam engine chart on the insert provided to your dealer with this catalog.

A word about the Buick Product Information Center.

If you are interested in further details about the contents of this catalog or any Buick product, we have developed a personal, informative communication service called the Buick Product Information Center. For information, call toll free **1-800-85-BUICK (1-800-852-8425).** We can tell you everything you need to know to make an informed decision to buy.

BUICK
Wouldn't you really rather have a Buick?

Ident. No. 85-BA003 1.5mm

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