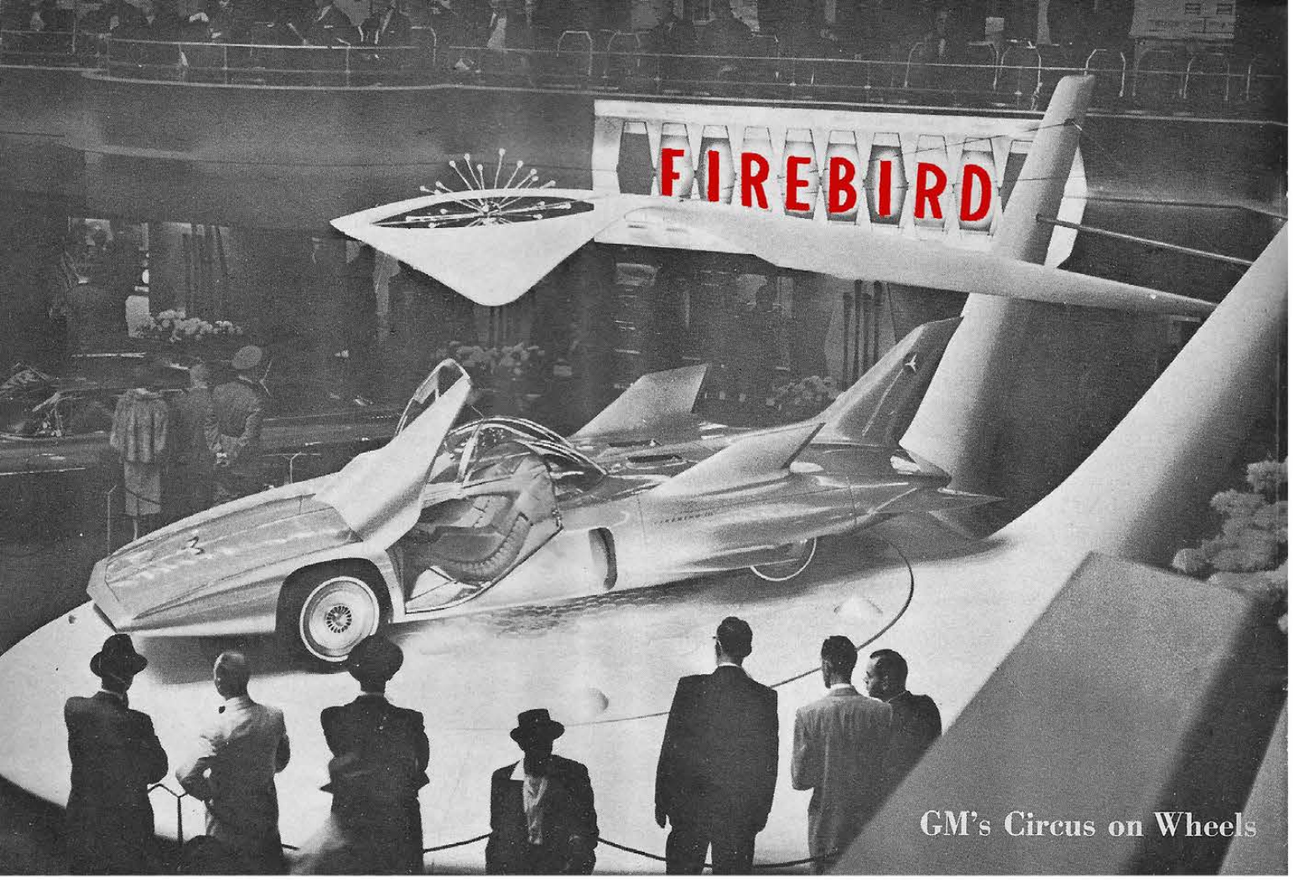


On display at Waldorf-Astoria, Firebird III is cradled by Firebird IV.

Photos by Irv Dolin and GM

by Stephen F. Wilder

NOW, LOOK, don't get us wrong. The Firebird is not our idea of a sports car. Sure, it has fenders and all that jazz, but basically, it's a circus car. Maybe twenty-three clowns don't come tumbling out when the doors fly open but it's every bit as attention getting—and impractical. But interesting.

And this is exactly why Generous Motors builds such cars. Even without such dream projects as the Firebird series and the various "cars of the future", the engineers and stylists at the Tech Center always have plenty of interesting projects under way. Each one is thoroughly tested in a working car but putting all the crazy Easter eggs in one mad package pays greater dividends in several ways. From the press coverage point of view, the amount of attention devoted to one spectacular is far greater than the sum of the news items about the individual items there in. The whole, in this case, is greater than the sum of its parts. For proof, compare the number of pages devoted to the Firebird III in this issue with the single column about Unicontrol in last month's issue.

OK, so, as a publicity gimmick, it works. Why else?

To answer this properly, one must understand that engineering, like life, is full of compromises. Conflicting requirements that meet head-on must be resolved. The successful designer is one who, in resolving them, achieves consistently satisfying (though compromised) results. In a project like the Firebird, the problems in this area are purposely intensified, and traditional solutions are avoided. Every possible component is off beat. This obtains maximum publicity value, showing off GM's talent at designing novelties. It also forces the designers to exercise their imaginations strenuously in order to fit everything together. It's one thing to design a turbine engine. It's another to fit it into a car and make it work. But it's really impressive when they combine this with umpteen other equally *avant garde* features and make all of them work.

Many divisions of GM contribute something, whether it's Harrison with a new radiator or Delco-Remy with something electrical. Given a problem to solve, each puts some talented people to work. Though they start with a relatively clean sheet of paper, they soon discover that this is a real automobile that must work, and horror upon horrors, it's got to be built and running by a certain date! No getting around it, shortage of time is one of man's greatest incentives.

Each of these project groups finds it must give as well as take in its dealings with the others. Sometimes they have to abandon a beloved idea because it is just plain incompatible with the rest of the layout. Sometimes they force others to bend something that "ought" to be straight. But in any case, they are forced to think and to create. What better challenge is there for a designer?

The end result is that everybody works hard, new ideas are born, talented people in the far-flung divisions get to know one another and finally a product is available, first for test and then for display to the public.

General Motors has been compared in some seriousness with the military services for size and complexity. So perhaps it's justifiable to use a military analogy. The creation of the Firebird III may be likened to a vast war-game which is subsequently exploited in the press for recruiting and/or appropriation benefits. Plan, execute, then publicize.

In GM's case, the whole thing is a technical orgy from beginning to just short of the end. That's when the press bureau takes over to put the name of General Motors once more before the public's eye.

Now some of us may be offended by the styling. That it is way-out cannot be denied. It is thoroughly impractical, too. But so are circus costumes. Remember, like both the earlier Firebirds, this is a circus car, and its single most important design criterion is to attract attention.

When the Firebird I was displayed at the Paris Salon several years ago, the GM brass that went overseas with it all crowded around the Pinin Farina stand to look at the prototype Lancia "Florida"; a clean, crisp four-door sedan if ever there was one. But the Frenchmen were all thronged around the Firebird. And forty-million Frenchmen can't be wrong, you know. Especially when they're prospective customers.

Nine-finned autos belong in the same category as purple cows; we'd rather see than own one. But four of the nine can be justified rather neatly on functional grounds other than conspicuous finsumption. It seems that in blocking out the car on paper, the wheels were far and away the highest objects at their respective stations fore and aft. In order to achieve both minimum frontal area and the best possible profile, yet still have fenders that cover the tires, the basically oval cross-section is bulged slightly just above the tire. Fair this in lengthwise and presto, there's a fin!

The four (!) lowest rear fins, placed about where you might see nerfing bars on less esoteric machinery, are said to be very effective in guiding air near the wheel cutout. If true, this is worthwhile, as turbulence here can stir up lots of unneeded drag. The other four fins already mentioned also get credit in this field. As for the ninth fin, well, surely one more won't hurt.

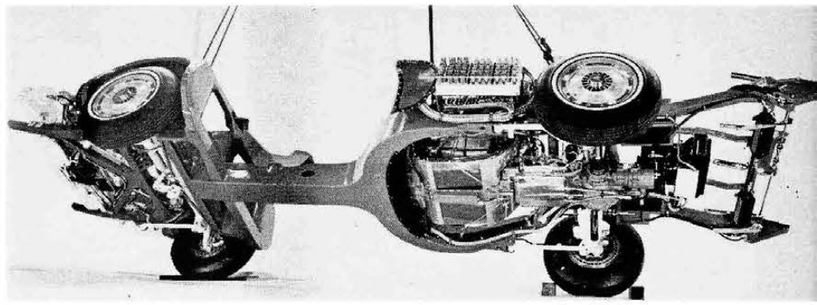
Something the Styling group may be more justifiably proud of, in our opinion, is that except for the name, no chrome or stainless trim mars its surface. Painted Lunar Sand (there we go again) throughout, the excitement of line comes entirely from the shape. Being so complex, this is not too surprising. What did startle everybody was the fascinatingly sinister look of the glossy black, full scale plaster mock-up. Looking like a fugitive from "Sea Hunt", it was used to make the female molds for the Fiberglas body panels.

Like the curtain walls of a glass and concrete office building, the skin just hangs there, carrying only air loads. Most of the panels are on hinges and some will even open under power. All are removable, yet not a single screw head or other fastener appears on the upper surface.

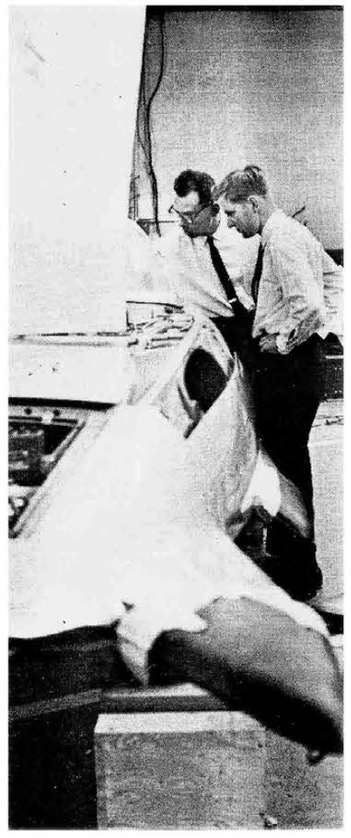
As they are taken off, the Firebird looks more and more like the Cape Canaveral sort of "bird". Every nook and cranny overflows with devices, gimmicks and little black boxes. Actually, black is about the only color they don't use and chromium strikes back in a big way on all the little bits of plumbing that "just wouldn't look right if we only painted them". Remember, this "special" is also a Concours D'Elegence entry. Don't think *that* doesn't give the crew a few headaches as show time nears.

The passenger compartment, about which more later, separates two power plant areas. Up front is a small, water-cooled flat twin. It drives enough hydraulic pumps and alternators to handle all the auxiliary power functions; power steering, braking and throttle, full-time air conditioning, and air-oil suspension. In back is a 225 hp gas turbine which has only one task; propelling the Firebird.

There's a reason for this separation. The pumps and generators have to be geared to their power source in such a way that they can work at full strength even when the car is idling. But when the car is running full tilt down the road, these auxiliaries are spinning like mad, eating

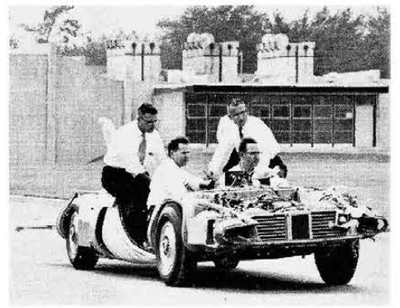


In addition to actual car, a "show chassis" too is concours-prepared.

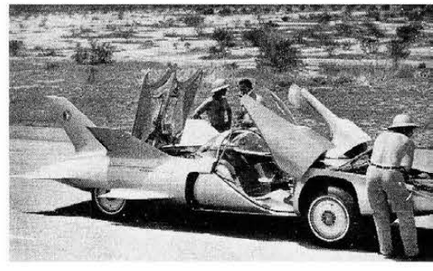


Styling Dept's Stefan Hapsburg explains some of the Firebird's intricacies to the author.

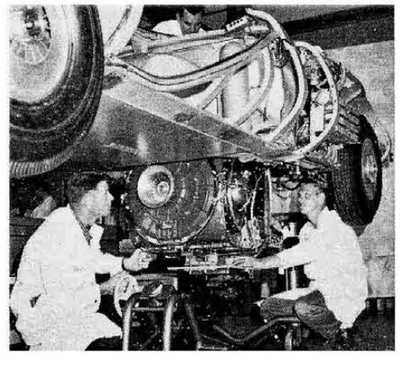
Engine enters chassis from below. Front mount is wide plate to allow for ¼-inch growth at high temperatures.

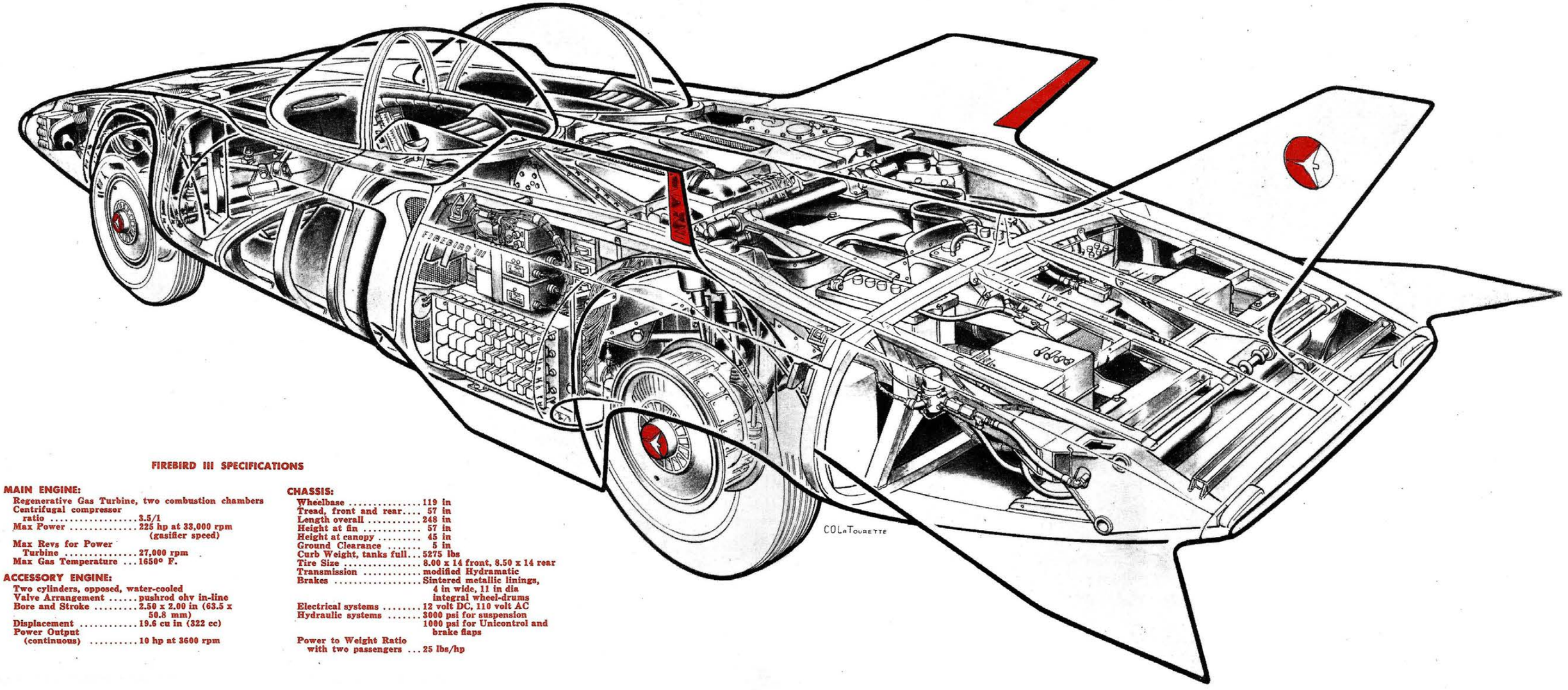


As with any "special", the builders all want to be in on the very first ride. Four made it, a mere 100% overload.



Next stop after final bodywork was GM's test track at, appropriately, Phoenix, Arizona. Here adjustments were made and difficulties ironed out.





FIREBIRD III SPECIFICATIONS

MAIN ENGINE:

Regenerative Gas Turbine, two combustion chambers
Centrifugal compressor ratio 3.5/1
Max Power ..... 225 hp at 33,000 rpm (gasifier speed)
Max Revs for Power Turbine ..... 27,000 rpm
Max Gas Temperature ... 1650° F.

ACCESSORY ENGINE:

Two cylinders, opposed, water-cooled
Valve Arrangement ..... pushrod ohv in-line
Bore and Stroke ..... 2.50 x 2.00 in (63.5 x 50.8 mm)
Displacement ..... 19.6 cu in (322 cc)
Power Output (continuous) ..... 10 hp at 3600 rpm

CHASSIS:

Wheelbase ..... 119 in
Tread, front and rear.... 57 in
Length overall ..... 248 in
Height at fin ..... 57 in
Height at canopy ..... 45 in
Ground Clearance ..... 5 in
Curb Weight, tanks full... 5275 lbs
Tire Size ..... 8.00 x 14 front, 8.50 x 14 rear
Transmission ..... modified Hydramatic
Brakes ..... Sintered metallic linings, 4 in wide, 11 in dia integral wheel-drums
Electrical systems ..... 12 volt DC, 110 volt AC
Hydraulic systems ..... 3000 psi for suspension 1000 psi for Unicontrol and brake flaps
Power to Weight Ratio with two passengers ... 25 lbs/hp

up power as if it were going out of style. This, to say the least, has a deleterious effect on gas mileage. What to do?

GM's answer: use two engines, one to drive the car and another to run the gadgets. The auxiliary power unit (APU), designed and built by the GM Engineering Staff, operates at a constant 3600 rpm, which allows the use of lighter, smaller accessory units of much higher than usual efficiency.

It's rated at ten horsepower which isn't much for 322 cc, even at this speed, but specific output wasn't as important as reliability and quietness. Technically, it's interesting in that each crankcase half is cast in a unit with a cylinder block and cylinder head. Furthermore it's all aluminum without any liners or chrome plating on the bores. The secret is a high silicon content which makes it wear resistant. Just to wrap it up, the patterns were designed for die casting, though the few engines actually built were cast more ordinarily. Weighing but 53 pounds, it uses a pushrod and rocker set-up similar to the Chevy V-8's.

Driven directly off the rear of the APU is a 110 volt, sixty-cycle, three-phase alternator (generator of alternating current) which can be used also as a synchronous motor. Ostensibly provided so the occupants of the Firebird can plug in an electric razor or watch a portable TV set while picknicking (?), it's really there so that the exhibitors can plug in the Firebird to make all its gadgets do things for the audience. In this condition, it declutches from the APU but continues to drive the hydraulic pumps and the 12 volt alternator through a series of flat belts. Originally notched timing belts were used but these made too much noise. The 12 volt AC is fed to a selenium rectifier, the resulting 12 volt DC serving the usual automotive purposes.

Two hydraulic pumps are required, the 1000 psi outfits serving the steering, braking and throttle control systems while a 3000 psi aircraft-like job handles the air-oil suspension system. The higher pressure permits reserve tanks of one-third the size otherwise needed. The arrangement of the control system was discussed in last month's issue; again we see no steering wheel in the cockpit, just a centrally spotted "Unicontrol" joy-stick and a single "panic pedal" which activates the reserve system for emergencies. Sorry, no ejection seat! Maybe it comes on the deluxe model. Reverse is selected by twisting the palm-fitting control handle 20° either way, park by twisting it 80°. Finger-tip pressure on a Retard button activates a liquid-cooled transmission-differential brake. The coolant itself is blasted with air scooped in by the automatically opened, rearward hinged brake panels behind the main power plant. There are four of these panels, top and bottom, left and right of center line. They also open under normal braking above 30 mph. Like the brake lights set into the trailing edge of two of the fins, their behavior is proportional to the movement of the Unicontrol joystick. Major braking effort is performed by the four-inch wide drum brake in each wheel.

These Turb-Al brakes are quite splendid. Though the sprayed-on molybdenum braking surface is integral with the aluminum center section, the separate rims are in two pieces (inboard and outboard). They are fastened to the wheel proper with fourteen inch circlips! As well as providing a means of changing the tubeless tires without hammering at the soft aluminum rims, a further advantage of separateness is the heat barrier thus erected between tire and brakes. Hot brakes, cool tires.

Linings on the two trailing shoe (but all-servo) brakes are the Moraine division's newly announced sintered metallic pads, the same as those used on the secondary shoes of the Corvette.

The center section of each wheel is a beautifully cast centrifugal blower. Air enters on the outboard side into eighteen openings near the hub, moves toward the rim through bifurcated passages which then sweep inboard across the "outside" of the braking surface, letting the air exit through 36 openings along the inboard rim. Unlike ordinary centrifugal blowers, the shrouds here are integral so that the more mundane tasks such as securing the tire to the car may also be fulfilled.

These wheels were brake-tested in a special tow rig. The only time brake fade was a problem was below 30 mph when the wheel turned too slowly to act effectively as a fan. At higher speeds, it just dragged and dragged, nearly wearing out the tow car in the process. Though they certainly don't look cheap or easy to build, they would certainly look good on a Grand Prix bolide. Just think, eleven inch drums inside fourteen inch rims. Four inches wide, too, and not even projecting into the airstream.

The brakes on each wheel can be overridden by an anti-skid control. Though the hearts of these four units are mounted in the front left fender, a sensing device at each wheel detects incipient skids from the associated reduction in braking torque on the backing plate. Electronic circuitry immediately reduces the hydraulic pressure to the brake concerned, preventing that wheel from locking up completely and sliding.

A fancy touch on the front wheels is that the hub-caps, sporting the Firebird III emblem are really mounted to the stub axle so that they don't revolve with the wheels. Somehow, they couldn't quite figure out how to do this on the rear ones.

An extraordinary touch at the front is the suspension. Suddenly it's 1930, for a rigid axle beam connects the two front wheels. Though no especial effort has been made apparently to keep it super-light, the concept here was to attempt to take advantage of the all-hydraulic steering.

Firebird III

Beam axles went out of favor because of their incompatability with steering geometry. As springs got softer and speeds grew faster, wheel tramp became an impossible problem. But on the Firebird III, there is no rigid steering connection between wheel and frame; nothing but high-pressure hydraulic lines.

The actuating cylinder itself is mounted right on the beam axle and though possibly unfortunate from a purist's point of view, it and two equal-length track rods and a pivoting arm are all just as unsprung as the axle and the wheels themselves. Unfortunate, that is, as far as ride is concerned, but from a steering slant, it's splendid. Bounce or rebound movements cannot affect steering angles as the steering mechanism and the suspension are one firm package, quite independent from the rest of the car.

As with the de Dion rear axle, location is obtained through four control arms. The lower, outboard pair run straight forward to the rubber-bushed frame mounts while the upper inboard duo run inboard and diagonally forward, equalling an A-bracket in their combined longitudinal and lateral locating function.

Springing and damping both are achieved through an air-oil system. Self-leveling devices work both on a fore and aft and a side to side basis with position sensors on both front wheels and the left rear. Actually the sensors follow the movement of the lower control arm in each case, picking up their motion only a few inches from the frame mounts.

"Skydrol", a non-flammable hydraulic fluid used extensively in the aircarft industry is featured on the Firebird III. It does have a drawback, though. It just plain dissolves most electrical insulations. The only exception is Teflon so naturally it, too, is used throughout.

Much of the extensive array of wiring is involved in the highly complex air conditioning system. Inside the cockpit there is but one control to be set, a thermostat. This determines what the interior temperature is to be and from there on out, it is all automatic. There are thermocouples all over the place measuring temperatures inside this and outside that and feeding the whole lot of info into one of the many shiny, mysterious boxes in the front compartment. This digests the information, ponders but a moment and then operates a variety of flaps, cams, butterflies and blower motors to ensure that suitable amounts of fresh outside air at whatever its temperature may be is mixed with a selected quantity of already warm (or cool) interior air and discharged at appropriate velocity into the cockpit. One vent, rather Citroen-like is directly in front of each passenger.

Incidentally, it's odd, but without a steering wheel, neither seat seems to be a driver's seat and therefore one thinks of the Firebird as having only passengers. Perhaps this symbolizes what some people think is wrong with automotive design, too.

But of all this heating and cooling paraphenalia, one pair of items makes up for everything, even the fact that you can't casually open a window. These are the two blowers, mounted on the bottom of each seat to draw cooling air through ventilated, countoured, thoroughly relaxing seats. Insiders at GM call them can fans.

I wonder what there is to keep the driver awake. The seats lay back like an English-built Bonneville streamliner's, they're heavily padded — at least, where they need to be, and they even have motor-driven, adjustable headrests and toeboards. Some even claim it's the first time they've been really comfortable in any car. And as far as driving is concerned, well, there's that Unicontrol stick again. Of course, if ever that gets to be too much effort, you just turn on the Autoguide and Cruise-control.

Autoguide is GM's answer to Turnpike Tedium. Two plastic covered prongs near the front axle swing down to sense a magnetic field around a cable buried in the center of the traffic lane. When one prong is closer to the buried cable than the other, the difference in signal strength is used to make appropriate steering corrections. Not very exciting from a sporting point of view but turnpike driving never was.

Cruisecontrol is a related gadget; with it the driver can select a cruising speed which the car will maintain uphill and down. These two devices eliminate in turn the two degress of movement of the joystick, leaving the two passengers—neither of them driving now—nothing to do but lean back on the adjustable headrests and listen to "Music to Ride By" or maybe even talk to each other on the intercom.

In order to give the people something to do, the trip odometer has an interesting twist. Not only can it be reset to any number including zero but it can also be made to run backwards, giving miles to go instead of miles gone.

You want to drive two hundred miles before you stop for lunch? Set it at 200, put it on subtract and get going. When it reads 000, start munching, you're already there.

The front half of the bubble canopy opens with the door, the whole massive unit pivoting about a skewed hinge line at the inboard front corner. More fascinating than its weird position when open is the news that there is no door latch at all. Instead, rubber seals along the edges are inflated with from five to twenty-two psi of air. Similar to the method of sealing aircraft canopies, this light pressure along the entire length of door edge grips tightly and at the same time fills irregularities to eliminate wind whistles.

To open these latchless doors? Why, we're glad you asked, say the GM publicity men. All you do, (now watch carefully) is snap an ultrasonic key—a mechanical version of the noiseless dog whistle and *voilá*, the doors swing open. Dunno what you do if you only want to open one of them though. So it does rain in on your mother-in-law. She's waterproof.

The microphones that listen for the whistles are located inside the air intake duct. So is the emergency latch which opens the engine cover when the battery is dead. Not to open the doors, mind you, just so you can recharge the batteries.

There's a new wrinkle in headlights. High beams are aircraft landing lights, the very thing we've often wished for when somebody wouldn't dim theirs. But low beam is cared for with a thin, horizontal fluorescent tube mounted within the nose. The horizontal slats which make up the "radiator grille" are actually parabolic sections. They focus the beam and simultaneously provide a cut-off to prevent dazzle.

In the cockpit, though, there's no headlight switch. Instead two photoelectric cells, mounted flush in the skin behind each doorway, turn them on whenever it gets dark. Two of them, so shadows of trees, for instance, won't trigger them too soon. Like many of the gadgets on the Firebird, it's an interesting idea but why bother? Besides, what if it's a big tree?

We're used to looking into Detroit engine compartments and not seeing the engine for the rest of the clutter but we were hardly prepared for the dazzling confusion which surrounds and hides the Whirlfire GT-305 regenerative gas turbine.

Confusion, because gas turbines are built, so to speak, from the inside out. The turbine shafts are its heart and soul and everything else, essential as it may be, takes pot-luck as far as location is concerned.

Dazzling because everything seems to be chrome-plated. For more than just appearance's sake, too. Unlike piston engines, turbines are cooled internally. That is, more than enough air to burn all the gasoline runs through the system. The only purpose for this excess is to keep temperatures at the turbine blades within reason. Additional air for cooling blows around the outside of the turbine. To make the latter more efficient, neighboring components are protected by highly polished, chrome-plated shrouds. The result is that a casual glance into this part of the Firebird reveals practically nothing.

The outstanding feature of the GT-305 is its regenerators. Self-cleaning as they rotate through the hot exhaust, they cool it to 300-500°F. The heat thus absorbed is dumped into the compressed intake air. Unlike piston engines, turbine efficiency is increased by raising the temperature of the intake charge.

The first stage of the turbine is called the gasifier, it is on the same shaft as the 3.5 to one centrifugal compressor and its only job is to spin it. Max revs are 33,000, power then is 225 hp. The second or power stage turns at a mere 27,000. This feeds into a modified Hydra-matic; to keep it from being too modified, a reduction gear brings the rpm within reason. Bolted right to the Hydra-matic (which has no fluid coupling) is the differential casing. From this, doubly U-jointed half-shafts pass the word on to de Dion-located rear wheels.

Having worked our way to the rear of the Firebird III, what better way to end than the way the French do:

FIN

Stephen F. Wilder