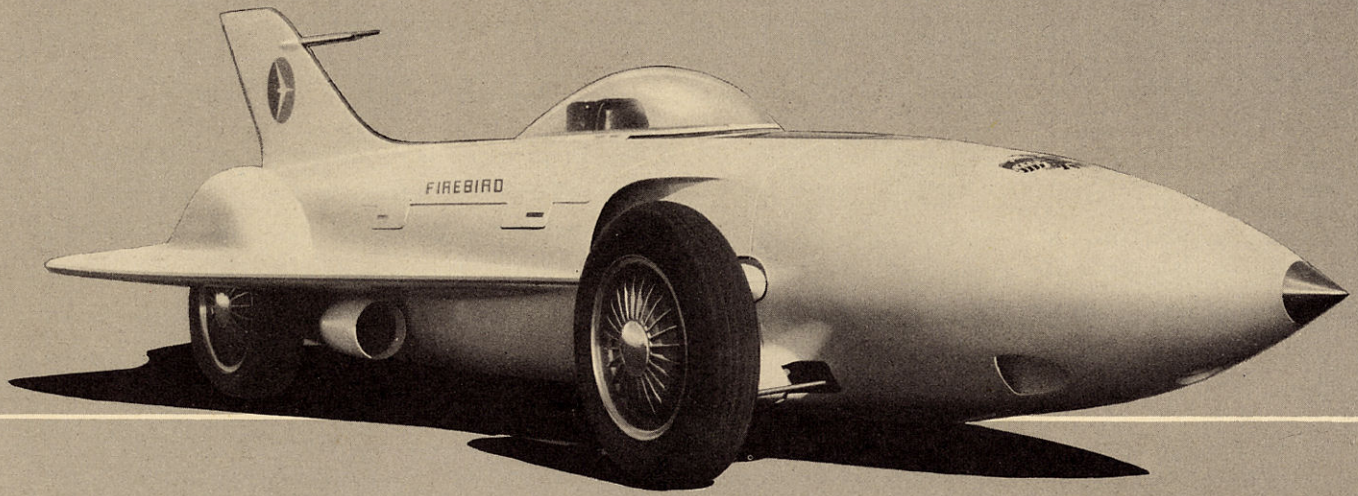
The XP-21 Firebird



General Motors' Newest Experiment on Wheels

The Story Behind the XP-21 Firebird

The XP-21 Firebird is the first gas turbine automobile ever to be built and tested in the United States.

It is not the first in a new line of General Motors cars. It will never be seen on a public highway. Actually, it is built only for the proving ground and test track.

What is the XP-21 designed to prove and test? First of all, this sleek, white single-seater is a vehicle for the study of the future possibilities of the gas turbine for commercial uses. It is part of an over-all General Motors research and engineering program to examine every known form of motive power.

But this important fact should also be noted: Although the prodigious power and speed potentials of gas turbines are well known, GM is not trying to develop either overwhelming horsepower or tremendous speeds in this test car. Rather, we are trying to determine whether the turbine can be harnessed to give efficient and economical performance in the low and normal automotive driving ranges.

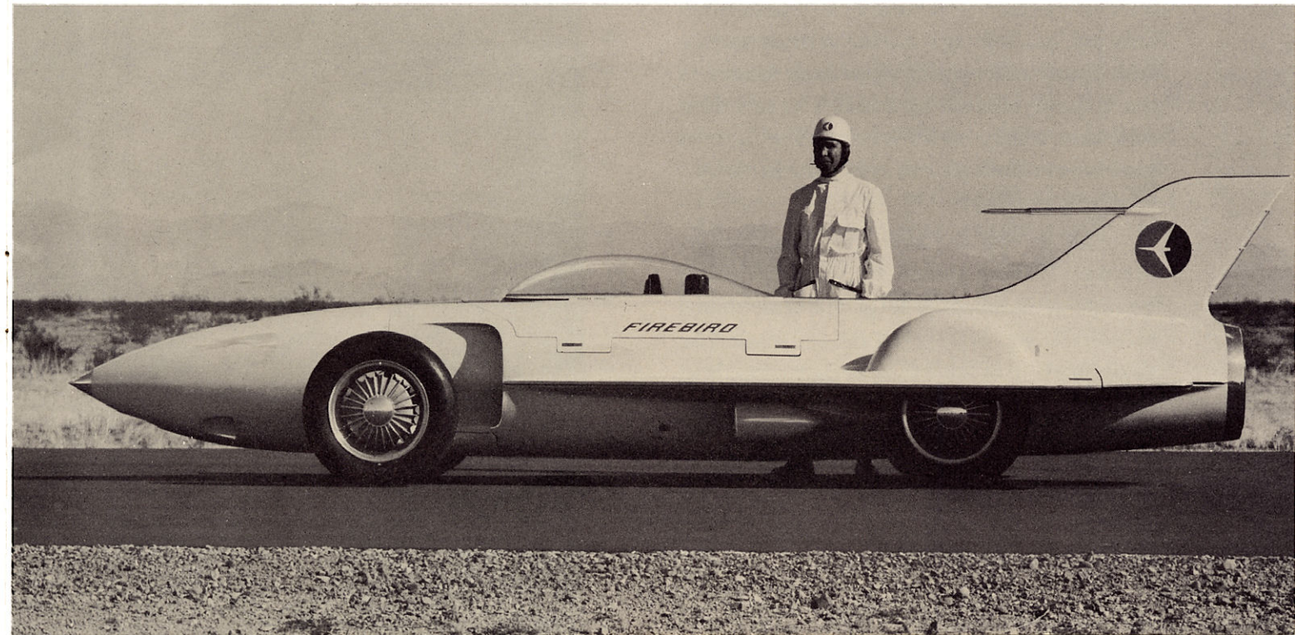
An Old GM Custom

It has long been a GM custom for our stylists, engineers and researchers to design, build and test "working samples" in scanning the automobile's future. It is experimentation that goes far beyond sketches, drawings and theories.

In the past, this practice has produced such famed GM "range finders" as the Train of Tomorrow (1947), the automotive Y-job (1938), Le Sabre and XP-300 (1951), all of which were built to test both design and mechanical theories.

How the Firebird Was Born

The idea of the Firebird originated with Harley J. Earl, GM Vice President in charge of styling staff, who also designed its fiber glass reinforced plastic body. The car's Whirlfire Turbo-Power engine and the chassis were developed under direction of GM Vice President Charles L. McCuen, general manager of GM Research Laboratories Division.

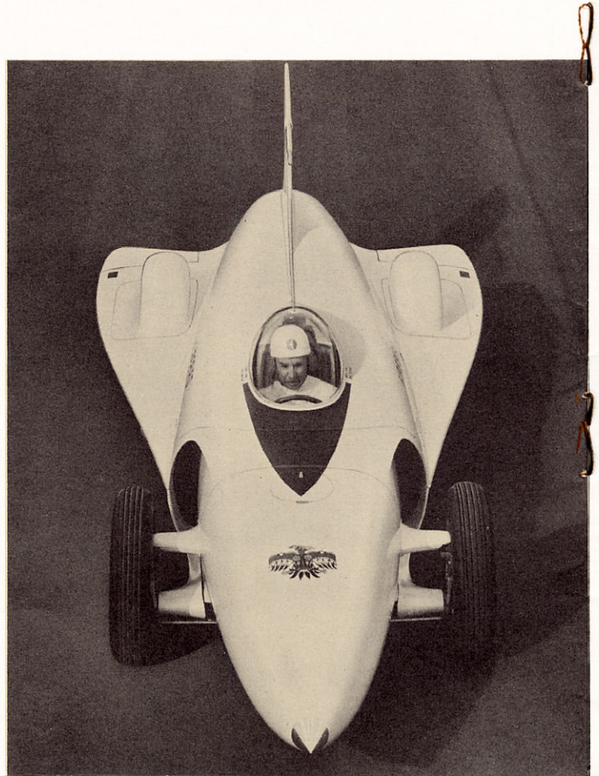


The aircraft motif is evident in the car's "needle" nose, delta wings swept back along the rear half of the body, a vertical tail fin and a plastic bubble over the driver's cockpit.

The Wind Tunnel Test

On a completely streamlined vehicle like the Firebird, a tail fin or some flat vertical surface behind the car's center of gravity is needed to give the body directional stability or to hold it on course when it is in motion. This is even more essential with a vehicle of the Firebird's aerodynamic shape.

In order to explore this idea thoroughly, General Motors called on the California Institute of Technology to give a scale model Firebird a series of wind tunnel tests. The unique styling of the car is in part a result of these tests.



The Tale of the Turbine

Automotive turbines have been under development at GM Research Laboratories Division for several years, but the introduction of the Firebird is the first public showing in this field.

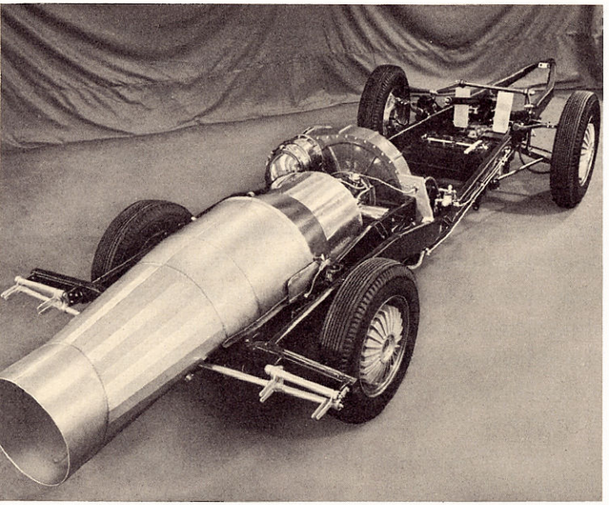
Mechanically, this gas turbine car is the reverse of conventional automobiles. In the nose, ahead of the driver, is a 35-gallon glass fiber-plastic fuel tank. Behind the driver is an integrated power "package" with an engine consisting of two mechanically independent parts—the gasifier section and the power section.

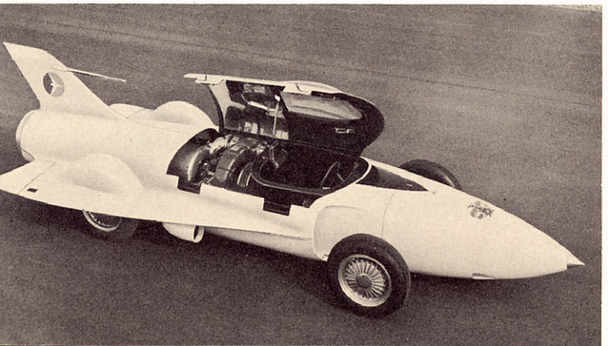
The gasifier section provides a source of compressed hot gas, and energy from this gas is delivered by the power section to the car's rear wheels. Thus, the gasifier section replaces the engine and torque converter pump in a conventional automobile, while the power section replaces the torque converter turbine, transmission and rear axle gears.

The Whirlfire gasifier section closely resembles a complete small jet engine. The exhaust gas, instead of firing through a tailcone to propel the car, is funneled through a power turbine that is directly connected with the car's rear wheels through a transmission.

Backbone of the gasifier section is a so-called compressor rotor and a gasifier turbine wheel, both attached to the same shaft. Air enters the compressor where its pressure is raised to more than 3½ times atmospheric pressure, before it enters the engine's two combustion chambers. Kerosene is burned in these chambers, raising the gas temperature to approximately 1500 degrees Fahrenheit.

The hot gas goes through the gasifier turbine which drives the compressor. The blast of hot gas from the gasifier turbine is funneled toward the second turbine, the power section turbine, which is connected with the car's rear wheels via a two-speed transmission.





Where the Firebird Gets Its Power

The Firebird's power comes from the power turbine, rather than the thrust of exhaust gas through a tailcone, such as the high-velocity thrust that propels a turbo-jet aircraft. This is the major difference between an automotive and an aircraft turbine.

The Whirlfire Turbo-Power engine develops 370 horsepower when the gasifier turbine is spinning at 26,000 r.p.m., and the power turbine is revolving at 13,000 r.p.m.

Total weight of the engine unit, including gasifier and power sections, is only 775 pounds. Over-all weight of the entire car is 2,500 pounds.

This gives the Whirlfire power plant and drive a weight-to-power ratio of approximately two pounds per horsepower. This ratio is about one-third of a conventional piston engine and drive.

The entire engine fits into a space 63 inches long, 26 inches deep and 32 inches wide.

The Firebird's over-all length is 222.7 inches, as compared with the Cadillac's 220 11/16, and its width is 80 inches at its widest point, the tips of its swept-back delta wings. It is only 41 inches high at the top of the plastic bubble over the driver's cockpit and 55 inches high at the top of the rear vertical fin.

Wheelbase is 100 inches with 54-inch front tread and 50-inch rear tread.

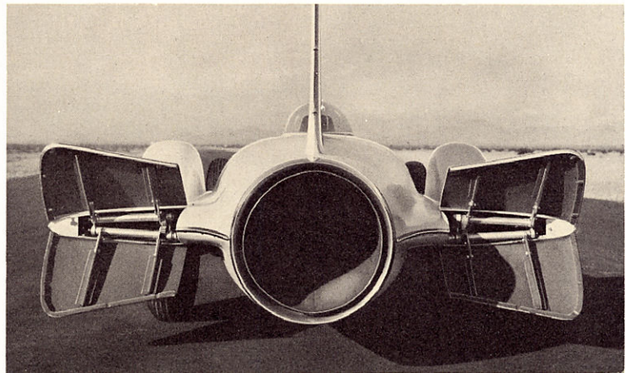
The wings have a functional purpose with their brake flaps on the trailing edges. They are electrically controlled from the steering wheel with aircraft-type actuators.

The Firebird's main braking system differs from conventional design with brake drums outside rather than inside the wheels. Location and design of the brakes facilitate rapid cooling.

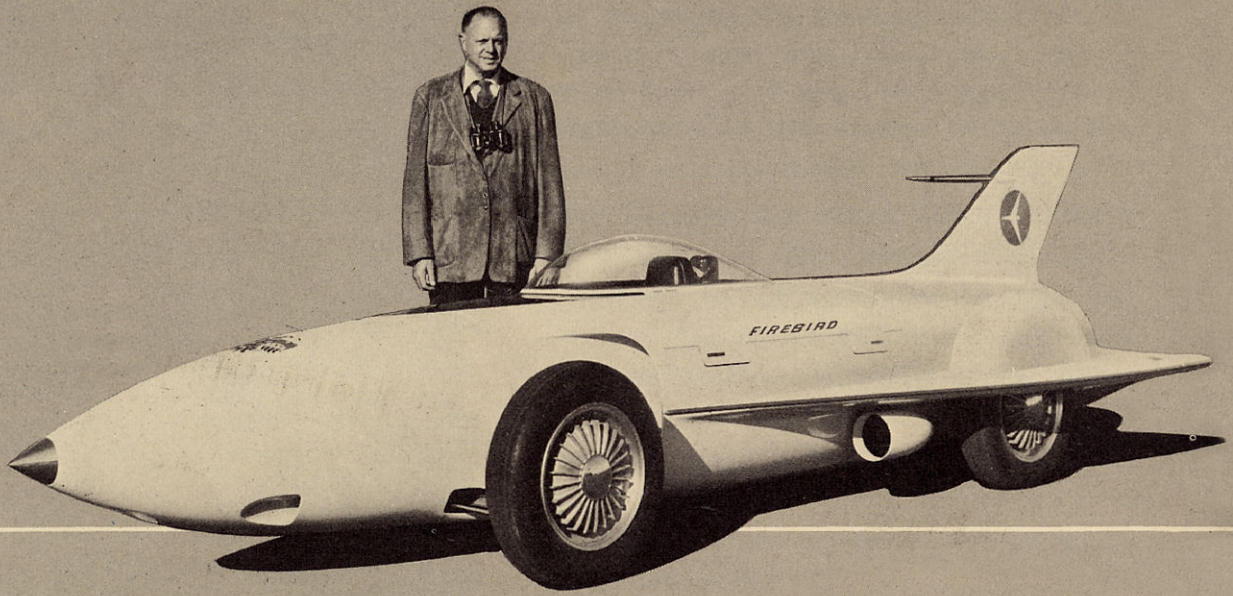
The car's suspension also differs completely from any standard car's suspension system. GM Research engineers call it double wishbone front suspension with torsion bar springs.

They describe the rear suspension as a deDion Type. The axle is suspended with two single leaf springs and included in the assembly is a so-called "walking beam" stabilizer unit.

The car's exhaust outlet resembles the tailcone of a jet aircraft. It is much larger than the exhaust pipe of a conventional engine, a necessity with gas turbines because of the comparatively large air volume they swallow, digest and expel.



Further Proof that in Styling – in Engineering –
GENERAL MOTORS Leads the Way



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