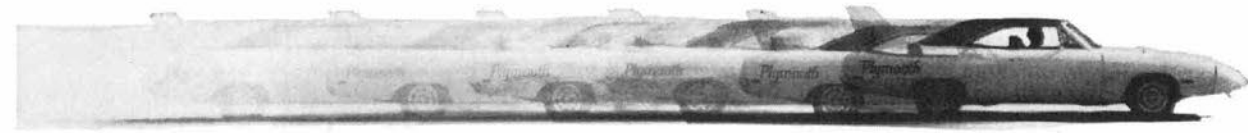
THE THING OF SHAPES TO COME

By A. B. Shuman

Photos by Fred Enke and Chrysler Photographic



Plymouth's SuperBird – Love it not for itself, but for what it stands for.

Cross a toucan with a Road Runner and what have you got? A SuperBird! And when you first see one, the thought that immediately flies to mind is that Plymouth's big-beaked limited production racer with the fancy tail sure looks a lot like Dodge's big-beaked limited production racer with the fancy tail. But don't write off the SuperBird as merely a mocking bird just because it was hatched by the same team that produced the Charger Daytona. Dodge just happened to be in Grand National racing last year, while Plymouth wasn't, so the Charger version was debuted first. It's true that both came from the corporate B-body race car development program and that the concepts used in both are the same, but the pieces are different. When Plymouth decided to get back into NASCAR racing this year, it was quick to make use of the additional wind tunnel and test track data that had been generated since the initial work with the Daytona. Thus, while the Daytona incorporated the basic idea of a low drag, streamlined shape combined with aerodynamic control surfaces for handling, the SuperBird has gone a few steps further in refinement and execution.

While Plymouth dealers won't have any trouble unloading the 1,920 that were built — they'll probably all be sold by the time you read this — the SuperBird wasn't meant to be a super road car: it's strictly a race car body package. In order to be legal for stock car competition, ACCUS (the Automobile Competition Committee of the United States) decreed that one car had to be built for every two dealers, and that's the reason for the street versions — they fulfill the requirement. They come through with a GTX-type 440 four-barrel (or optional 440 six-barrel or 426 Hemi), heavy-duty suspension, disc brakes, and power steering. The guys that buy them will be plumbing contractors and kids coming back from Vietnam with all that combat pay, and they'll take them out on the Interstate at 2 a.m. (right after that magic 500 figure has clicked by on the odometer) and see how fast they'll go. But whether or not it will top 140 off the showroom floor isn't important. How it will do on the race track and what carryover it will have for the whole production line is.

This whole area of race car aerodynamics and streamlining had been generally ignored until the last five-or-so years. In fact, the original concept of an "ultimate, all-out" stock car built within the confines of a production B-body shell, strictly through the use of "add-ons," was first discussed by Chrysler engineers like George M. Wallace and John Pointer only as recently as 1968, and the first rough sketches weren't drawn until January of '69. But serious interest in aerodynamics had been stoked by the shape of the original Chargers in 1966. Though designed by the stylists, with not too much thought given to its potential as a race car, it was assumed to have good aerodynamic qualities. In secret pre-Daytona tests at the Goodyear track in San Angelo, Texas, late in '65, it turned out to be significantly faster than anything else being raced at the time. But the big San Angelo track is circular, while Daytona has corners, and when the cars were brought to Florida in February, they proved to be almost impossible to control in the turns under full throttle. Drivers found that when they attempted to go through wide open, the rear end tended to come around.

After a less than glorious showing in the race, a ⅜-scale model of the car was taken to the Wichita State University wind tunnel for study. (At the time Chrysler did not have its own wind tunnel facility, but it is presently in the process of building one.) The tests showed that the car did indeed have very low aerodynamic drag, but compared to the standard two-door hardtops of the day, had a great deal of rear end lift. Thus, at high speeds, the rear tires wouldn't stay on the ground as well as the standard cars'.

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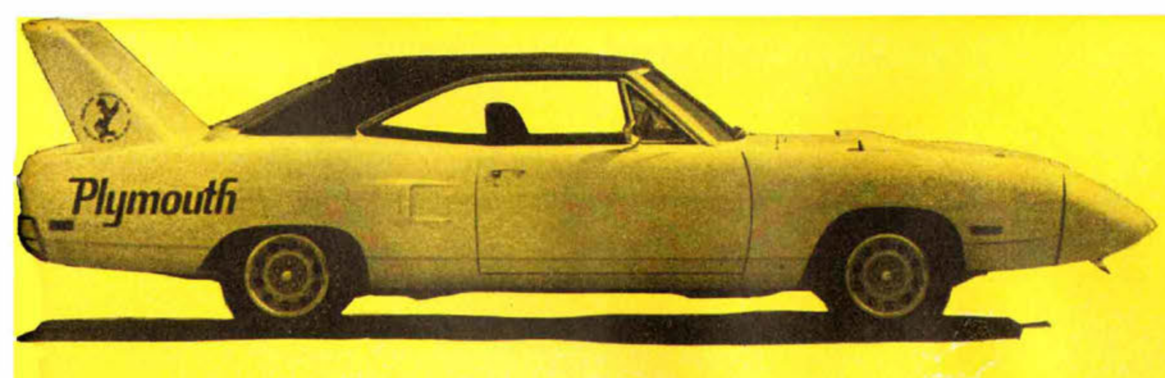

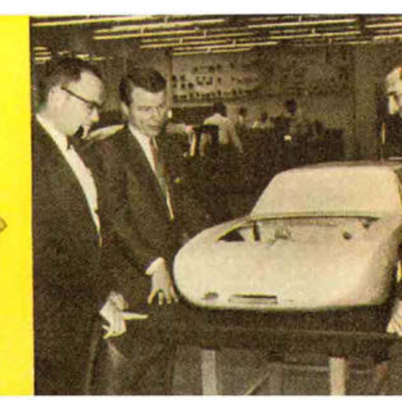

Over 220 inches long and capable of topping 220 mph in race trim, Plymouth's SuperBird is result of wind tunnel and proving grounds studies. 18-inch nose exension, front spoiler and new rear window not only lower drag, but couple with 23½-inch high rear stabilizer to markedly increase high speed stability. Key in its development were George Wallace, special vehicles engineering co-ordinator; Gary Romberg, race car aerodynamicist; and Bill McNulty, performance supervisor at proving grounds.

Low aerodynamic drag alone does not a race car make. The whole package must also be stable.

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The solution appeared to be simple: the addition of a rear deck spoiler. The spoiler, basically a vertical plate attached to the rear of the body, disrupted the smooth flow of air over the airfoil-like body to kill the unwanted lift. But too much spoiler can increase drag. Tests at Daytona established the optimum height of the spoiler above the rear deck so that drag, as well as lift, were kept within acceptable values. It all paid off: Charger won the Fourth of July race.

At the same time, the engineers were working on a '66 Belvedere which had been "improved aerodynamically" by smoothing up its lines to bring it up to the performance level of the Charger. It developed the same problems with rear end lift, responded to the addition of a spoiler, and eventually turned out to be faster than the Charger, turning the first unofficial 180 mph lap at Daytona. All of this proved that reduced drag alone doesn't make a race car; it's got to be aerodynamically stable, too.

In '68, there was a major styling revision in Plymouth and Dodge B-bodies, and since the change in the Charger was more radical, the emphasis was placed on wringing out that design. Here, the final shape had been determined by the stylists, but they had worked a bit with the engineers. The car turned out to be even faster than predicted, but was almost impossible to turn, the result of too much *front end* lift. Whereas the early Chargers had an almost flat front end and a large, deep, vertical bumper, which acted like a spoiler, the new ones had a rounded nose and a high, shallow bumper. By this time the use of the under-nose spoiler was already fairly common, with even the lowly Corvair employing one, so the remedy was obvious. Tests showed that at 180 mph the standard Charger had about 1250 pounds of front end lift (with a total static front end weight of 2200 pounds). The under-nose spoiler cut this lift to 500-600 pounds, making the car controllable at speed. The deep bumpers on the Plymouths negated the need for any similar devices for those cars. Actually, the '68 Plymouth and Dodge were about equal as far as aerodynamic drag, though it took considerable forward rake angle (about 3 degrees) to get good air-flow over the Plymouth backlight (rear window area) to accomplish this.

The Charger 500, with flush grille and plugged backlight, was the next step. By moving the grille out, smoothing out the rear of the "greenhouse" and making other small changes, the engineers were able to cut aerodynamic drag by 10 percent, a considerable improvement. Work on the Daytonas finally appeared above-ground, as the program had become official for all B-bodied cars before the '69 Daytona race, though the Plymouth version was postponed, because it wasn't participating in NASCAR racing that year. Two separate groups were given the job of developing the final package — the proving grounds group (under Bill McNulty), responsible for vehicle performance, and the engineering aerodynamics group (including Gary Romberg), handling the wind tunnel work. The groups worked on their preliminary sketches independently, arriving at remarkably similar proposals. These first "guesses" at what the cars would look like were very close to the final product, the biggest difference being in the size and shape of the rear stabilizer, which initially looked like the contrivance carried on the '69 GTO Judge.

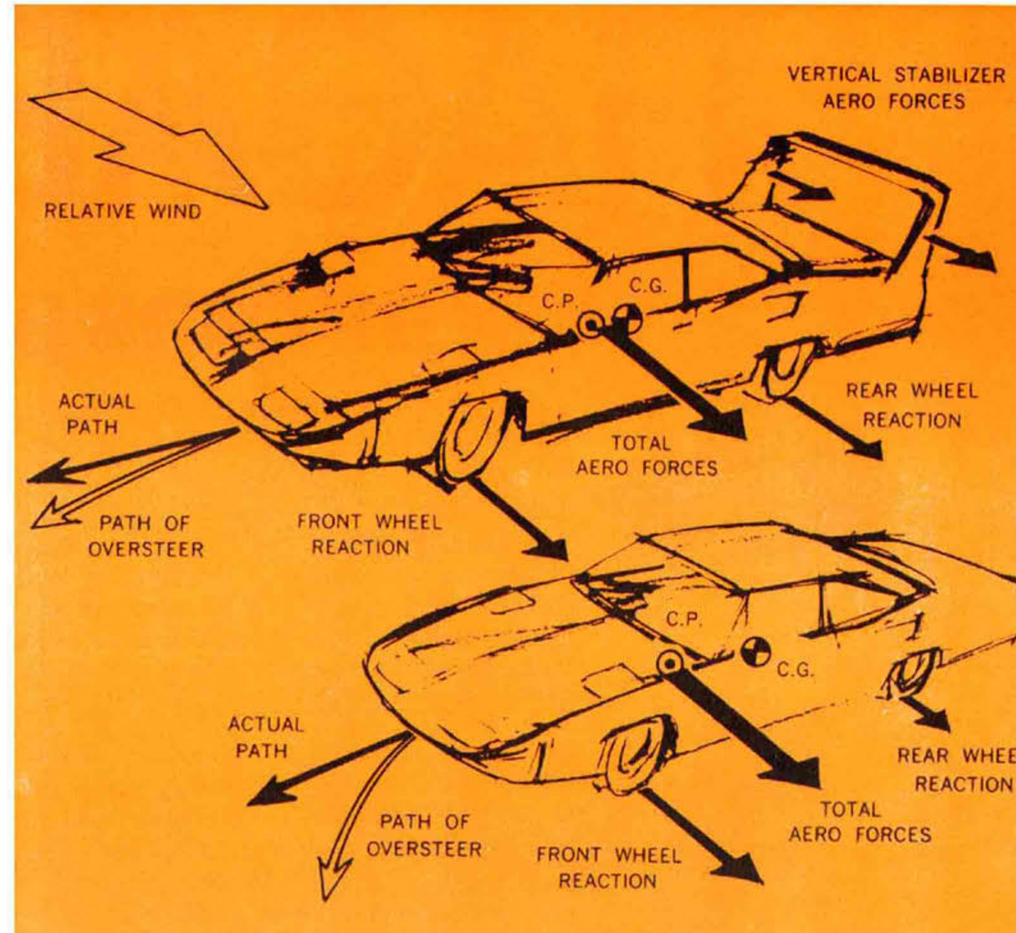
The development involved interplay between the proving grounds and the wind tunnel, with the proving grounds group able to quickly evaluate minor changes to the cars and the wind tunnel personnel able to rapidly check the effect of more radical changes to the basic shape. Two nose extensions, measuring 9 inches and 18 inches from the bumper supports, respectively, were tried. The longer nose section was finally adopted, as it produced lower drag overall in conjunction with the front spoiler, gave slightly better directional stability and — not to be overlooked — provided a place to put the headlights. The height of the rear stabilizer came out of tests at the proving grounds, in consideration of the flow over the top of the car. The high position (23½" off the deck lid) made it more effective, taking it out of the influence of the greenhouse, and permitting a more favorable lift-to-drag ratio. In the wind tunnel, the vertical supports for the horizontal stabilizer were found to contribute greatly to the vehicle's directional stability by moving the center of pressure (the point where the sum of aerodynamic forces can be said to act) aft and reducing the yaw moment. (On the SuperBird the area of the vertical stabilizers has been increased by about 40 percent.) An under-nose spoiler was employed to not only cut front-end lift, but to reduce overall drag. This latter function it accomplished by limiting the total airflow past the unstreamlined undercarriage of the car — and the less air passing under a car, the better. (Additionally, it aids cooling on the SuperBird, which has its radiator air inlet under the nose.)

The 500 Daytonas were built for on-road sales, but key attention was focused on the race track cars. They ran into early problems with overheating (due in part to the placement of the air inlet on the leading edge of the nose) and with tire wear (partly because of lag in tire development, partly because of unnecessary extra weight being carried), but have recently (at Rockingham) begun to come up to expectations. The SuperBirds will, of course, be able to benefit from all of this even before they hit the tracks.

Taking a look at these cars, there are a few touches which may not be readily noticeable to the casual SuperBird watcher: the standard rear window has been replaced with a convex piece and the windshield "A-posts" carry streamlining moldings. These last two items, and the flushing of side windows, are areas where you can expect to see the first contributions of race-connected aerodynamics to standard production vehicles. Gains in performance and economy are within the realm of reality even at normal road speeds. As one engineer put it, "An increase in the performance level might be a goal within itself, or it could be accompanied by a gearing change which would give the original performance with greater economy. There are all kinds of ways to work it."

Neither the SuperBird, or its cousin, the Daytona, could be described as "beautiful" or "esthetically pleasing," but they are functional. In the future you can expect to see a more successful blending of form and function, but, for now, these point the way. /MT

SuperBird differs from look-alike Daytona in more than location of air inlet, though concepts used in two were the same. Spoiler not only kills front end lift, but lowers overall drag by limiting airflow under car, and also aids engine cooling.



Cumulative effect of nose extension and vertical fins places aerodynamic center of pressure closer to center of gravity. Result is much greater directional stability. Vertical fins are chief contributor to this characteristic.

Without undernose spoiler and horizontal stabilizer, summation of high speed aerodynamic forces would be upward, but utilization of these devices acts to hold car on track. Angle of attack of horizontal stabilizer is adjustable.