FLYING AUTO THE LATEST MOTOR CAR

A new Paris aeroplane and automobile combined has the aeroplane mounted on a chassis motor worked by liquid gas. When the apparatus is well launched on its way, the force of propulsion and the resistance of the wind to the aeroplane, causes it to rise. The machine was designed by M. Vina of Paris.

Flying Air Car Designed With Hook-on Wings

W. B. Stout, shown above examining a model of his latest development, the "roadable airplane," operates on the theory that accepted methods "ain't necessarily so." Among the "firsts" he has designed by breaking consciously with the past were the first thick-wing plane, first all-metal plane, and Scarab car, called "10 years ahead of its time"

Stout's Aerocar, the flying family auto, is to be equipped with "hook-on" wings, shown being installed above. Shown below is the Aerocar in flight. Unlike the roadable plane, which is intended to be primarily a plane and secondarily a car, the Aerocar is, first, a good automobile

Stout's Aerocar would do 60 to 70 miles on the highway, and 100 miles an hour in the air with about the same gasoline consumption. Its air range would be about 250 miles. His roadable plane would be for use in the West, where distances are longer, and would have a range of 400 miles in the air, coming to the ground only if the weather is bad, and remaining on the road only until the storm area is passed. Its wings would fold for road driving. It would speed at 120 m.p.h. in the air, 35 m.p.h. on the ground. Above is a third of Stout's conceptions for postwar travel, a Helicab. He considers it most practical for use in congested cities, especially for home-to-office commuters. Stout says he foresees electronic controls to prevent collision and constant ground-air communication

Popular Mechanics
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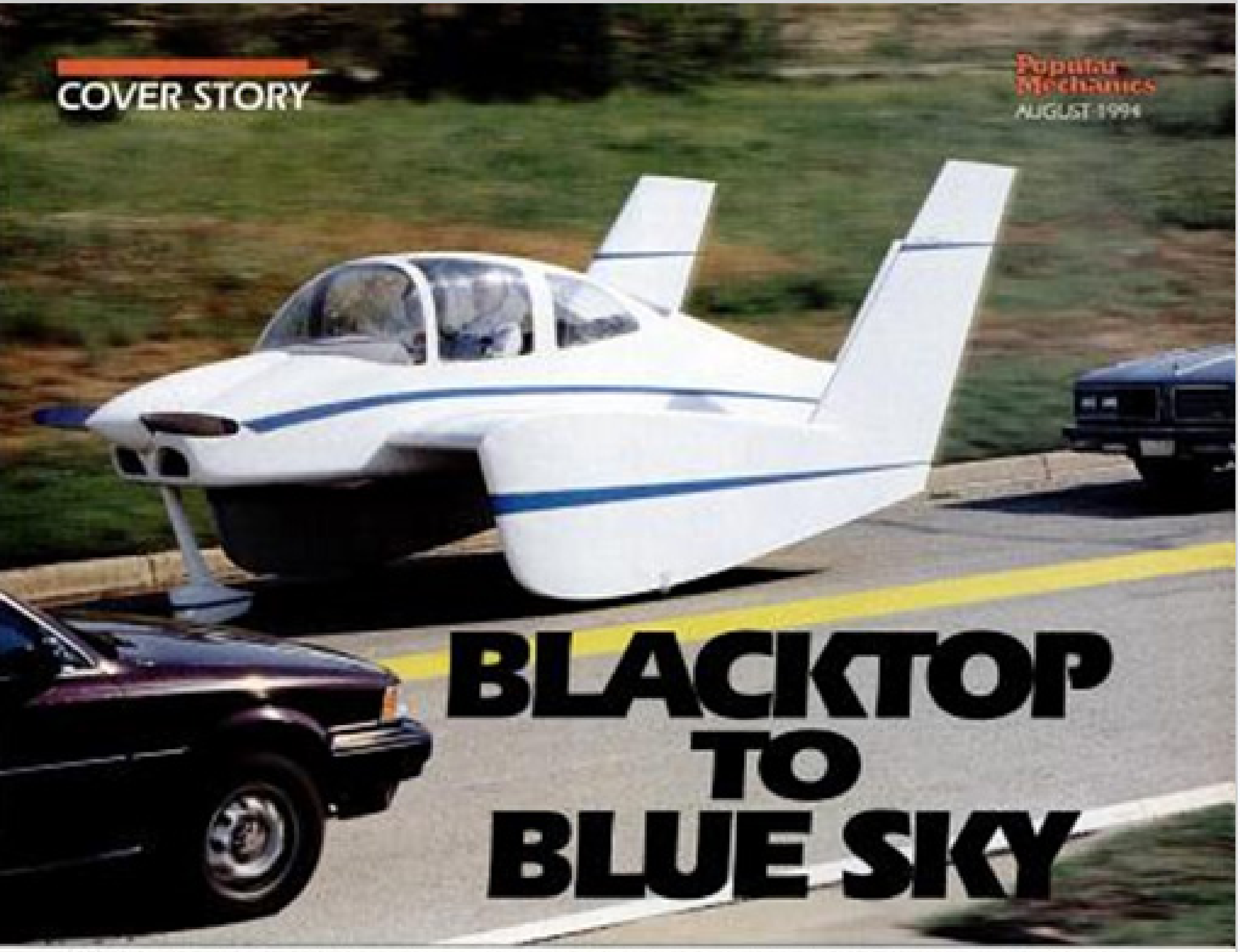


BLACKTOP TO BLUE SKY

With its street-legal silhouette and switch-hitting engine, the Aircar will take you from the highway to the high frontier.

BY DAVID FREEMAN; PM Photos by Ray Hand

• The details lie in plain sight. Propeller? Check. Steering yoke? Check. Hand-operated throttle? Check. Automotive brake and gas pedals? Check. Gearshift? Check. No doubt about it, this is a genuine hybrid, deftly mixing car and plane. But something seems missing—shouldn't it have wings?

"Those *are* the wings," says Kenneth G. Wernicke, as he points to the stubby projections on either side of his brainchild—a mockup of what he believes will be the first practical flying car.

"I'm no aviation engineer," says a visitor in Wernicke's dusty workshop, "but I don't see how this thing would ever fly."

Wernicke takes no offense. "Aviation engineers look at it and say the same thing," he retorts without a trace of irony.

At present, Wernicke's Aircar exists only as a flightless work-in-progress. But it's a full-scale manifestation of his dream—a craft capable of flying and driving in the same configuration. Without, in other words, the kind of preflight surgery that other flying cars have required. Not surprisingly, those stumpy, low-aspect-ratio wings are the key to making this possible.

In contrast to the Aircar, previous flying-car designs often incorporated wings that folded up or detached for stowage on a trailer. Some early designs even went so far as to employ a detachable aircraft engine, stored off the vehicle until takeoff time.

To Wernicke's mind, impractical designs such as these explain in part why previous "roadable aircraft" failed to catch on. Making matters worse, previous flying cars tended to be woefully underpowered, with limited airspeed and insufficient range for convenient, economical use.

The Aircar's innovative design addresses not only the wing problem, but also speed and range.

Equipped with the most powerful of the several options envisioned for production models—a 475-hp racing-car engine—a 4-place Aircar will have a maximum airspeed of 266 miles per hour. With supercharging, Wernicke calculates, that could rise to 310 mph.

Range—factoring in a pilot, one passenger and 50 gallons of fuel—should be 1300 miles in the air and 2200 miles on the ground. In road mode, the Aircar should be capable of 65 mph—just enough to avoid embarrassment on the highway.

If all this sounds plausible enough, one difficult question remains. Could wings that span only 10 ft. really generate enough lift to raise a 24-ft.-long 2800-pound machine off the tarmac?

According to Wernicke, the Aircar has proven itself in two separate wind-tunnel tests, conducted in Texas A&M's low-speed facility in College Station. And a videotape in Wernicke's possession shows a near-flawless performance by a radio-controlled scale model of the Aircar.

At motorhome width, proof-of-concept mockup fits within confines of a parking space.

Bell man

These accomplishments help stifle the urge to dismiss Wernicke as a kook. What's more, the 61-year-old entrepreneur comes with credentials. Impressive credentials. His *curriculum vitae* details a long and rather celebrated career as an aircraft engineer.

Wernicke's workshop, tucked behind a sun-baked industrial park in Hurst, Texas, is a stone's throw from the vast Bell Helicopter facility. There Wernicke spent almost 35 years designing a series of vertical-takeoff production aircraft. Wernicke cut his teeth on the legendary UH-1 "Huey" chopper, then went on to lead the engineering of the XV-15 and Bell's part of the V-22 Osprey tilt-rotor, among others. A plaque on his office tells it all: "Kenneth Wernicke, Mr. TiltRotor."

Wernicke made preliminary drawings of the proof-of-concept vehicle back in 1991, three years after taking early retirement from Bell. But his dream of building a flying car dates back to the 1950s.

"I used to tease my kids," he says with a chuckle. "I would be going down the road, and I would pull back on the steering wheel like I was going to take off. But when I sat down and tried to figure out how to make a real flying car, I could never come up with a satisfying answer. Then, sometime around 1965, it occurred to me that you could make a flying automobile if you used a low-aspect-ratio wing—like a paper airplane."

Fittingly, Wernicke used paper models to test his idea. They flew. But owing to their small, inefficient wings, their glide characteristics were poor—a seemingly insurmountable problem that Wernicke later confirmed mathematically. Discouraged, Wernicke put aside his flying-car project. He busied himself instead with his work at Bell—and in his free time, he built a series of playful projects, including a "flying surfboard" he towed behind his speedboat.

But over the next several years, Wernicke kept returning to the flying car. Each time, however, convinced him anew that a low-aspect-ratio flying car defied aerodynamics.

Lifting thoughts

In 1985, Wernicke had an important insight. "As I was making some calculations," he recalls, "it occurred to me that I shouldn't worry about aerodynamic efficiency. What I should worry about was simply 'Could it fly far enough to be a viable aircraft?' "

Wernicke determined that to have a range of at least 600 miles (the minimum he considered acceptable), the flying car would need a lift-to-drag ratio of at least 7.5. (Such ratios range from 12 or 13 for a private airplane up to 50 for a sailplane.)

Wernicke converted his thoughts into a little fleet of scale models, powered initially by rubber bands and then by gasoline engines. And in late fall of 1992, Wernicke tested his most successful design in the Texas A&M wind tunnel. These trials confirmed its flight performance and revealed something else to Wernicke. Because the design lacks a horizontal tail, both aileron and elevator function could combine into a single wingtip control surface called an elevon.

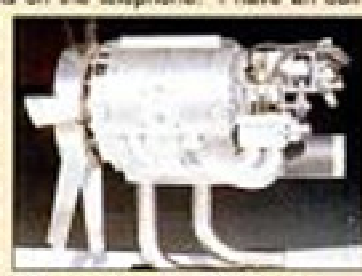
To prevent the roll and pitch instabilities that plague aircraft with low-aspect-ratio wings—especially at high speeds—Wernicke fitted the Aircar with winglets far taller than those commonly seen on production aircraft. Together with a set of lower winglets, these upper winglets not

What Happened To Moller?

● Three and a half years ago, Paul Moller seemed ready for takeoff. Only a few months, he told us, separated his own flying car—the Moller 400 volantor—from its maiden voyage. But today, a hollow airframe remains grounded at Moller's Davis, California, plant.

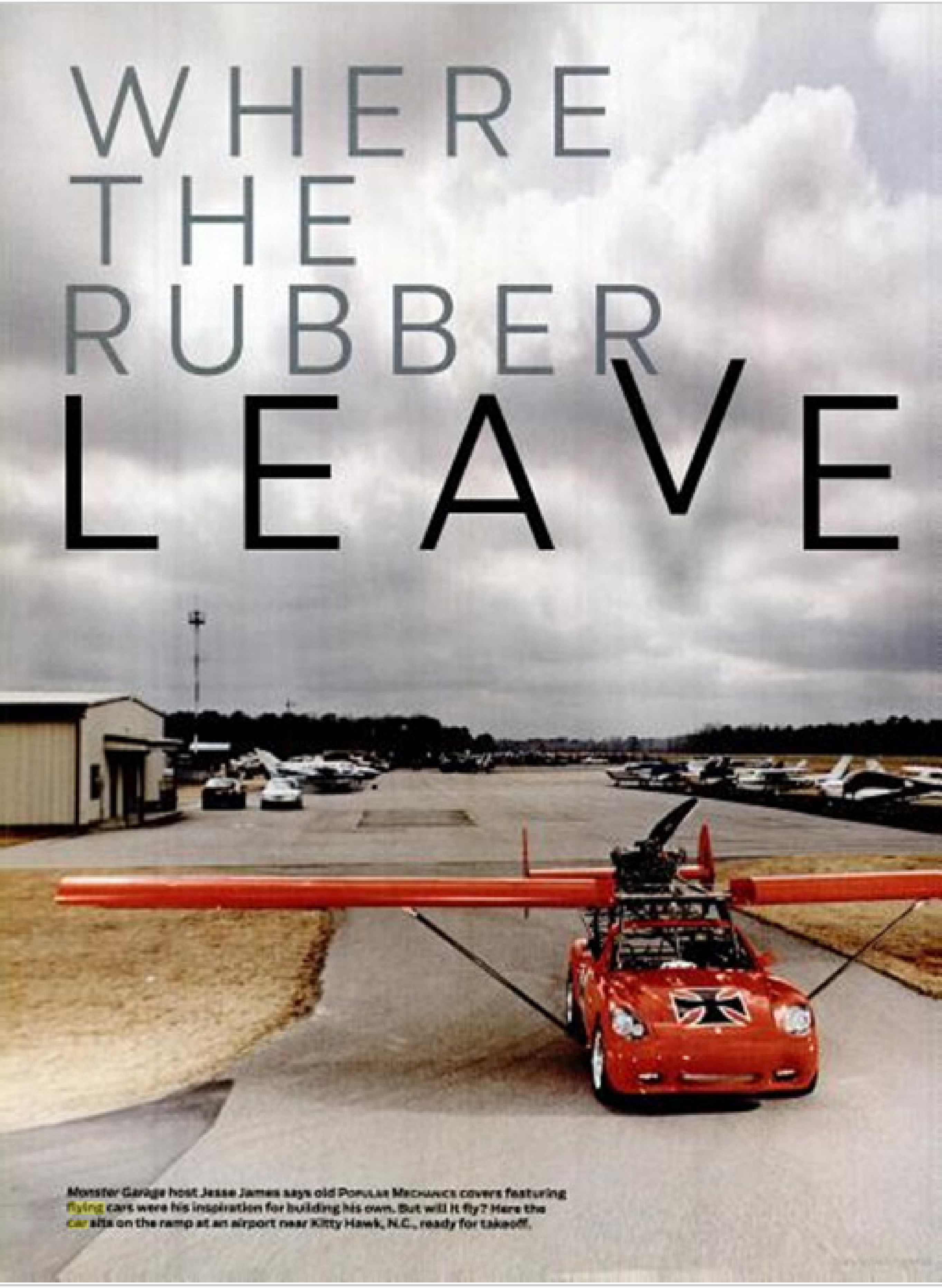
Why the delay? Engine trouble. Moller's concept depended on eight novel rotary powerplants. At 530 cc, each would yield 120 horsepower from a 68-pound package. To nurture the engine's incubation, Moller struck a short-lived deal to develop a 750-cc version for the boating market. Moller figured he could shoehorn this bigger engine into the M400. Trouble was, the shoe didn't fit, forcing Moller back to his original engine size.

Today, the finished 530-cc engine drones in the background as Moller talks on the telephone. "I have an obligation to get this engine company started. If we are going to have an inexpensive aircraft we need an inexpensive engine, and that means high volume." And what does that mean for the volantor's future? "It's still my prime focus," says Moller. "I haven't abandoned the dream—just taken a detour." —*Gregory T. Pope*



Moller's single-rotor 530-cc engine, finally complete, will power his volantor.

WHERE THE RUBBER LEAVE



Monster Garage host Jesse James says old Popular Mechanics covers featuring flying cars were his inspiration for building his own. But will it fly? Here the car sits on the ramp at an airport near Kitty Hawk, N.C., ready for takeoff.

AUGUST 1994

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S THE ROAD

To cap off the hit show's third season, *Monster Garage* host **Jesse James** decided to build a flying car. Or at least look good trying. Jesse's not doing it to be able to sell flying cars to the public or even for the technical challenge—he just wants to prove he can.

BY MIKE ALLEN

PHOTOGRAPH BY NATHANIEL WELCH

IT'S DAY FOUR of a five-day build, and the nine-man *Monster Garage* team has reached its first crisis. The project being tackled is ambitious even by the audacious standards of a show that has turned a Mustang into a 50-mph lawnmower, and a school bus into a party boat. In the center of the Long Beach, Calif., shop, a number of mechanics are chipping away the shell of a partially dismantled Panoz Esperante, an exotic aluminum and carbon-fiber sports car built in Atlanta. Nearby, another group is riveting 4 x 8-ft. sheets of shiny aluminum to form the skin of a wing about 16 ft. long, 5 ft. wide and a good foot thick. Another wing's worth of ribs and spars is stacked under a table. Sparks fly. Pneumatic riveting hammers tattoo intermittently. An HDTV camera on a 30-ft. boom silently circles the action like a UFO, poking its nose in tight for the closeups, backing off for the wide shots. There's a substantial pile of leftover Esperante parts in the corner of the shop, as nearly a thousand pounds of car have been removed to lighten it.

Within 36 hours this car has to be ready to fly.

An increasingly loud discussion at the back of the car attracts several crew members—and the hovering camera. Over the rear of the vehicle, one group has fabricated an articulated frame out of steel square tubing. On top of it is a Lycoming O-320, a 200-plus-pound, four-cylinder aircraft engine salvaged from a hurricane-damaged Cessna. The crew wants to make the engine retractable, rising above the wing for flying, and then returning to what used to be the trunk when it's time to drive with all four wheels on the ground. The strength of the engine mount has become the subject of debate. Vigorous debate, actually.

Like all *Monster Garage* build teams, this one is a patchwork of people from different backgrounds:

three engineers on loan from Cessna, a couple of guys from Atlanta Air Salvage, two mechanics from Panoz, a couple of aircraft enthusiasts and fabricators, and a fellow who's been working on his own flying car project for years. Now they're split down the middle. The fabricators have spent two days cutting and welding to make the mount glide up and down. They think it's more than adequate. The engineering staff sees the structure's flexibility as a potential liability. If the car makes a hard landing, the engine could conceivably break free—and seeing as how it and its rapidly rotating propeller are mounted about 2 ft. from the pilot's head, this is cause for concern.

And seeing as how the pilot is going to be Jesse James, *Monster Garage*'s host, head fabricator and principal butt-kicker, there's really only one way to resolve the dispute. Jesse rises from his workbench at the rear of the set and walks over to the car. He pokes and prods the engine mount, seeming to ignore the debate still volleying back and forth around him. He rubs the back of his head, the part closest to the propeller, then points at the mount with his other hand. "Screw it," he says. "Cut it off and make a solid mount out of roll-cage tubing." End of discussion.

Jesse retreats to his workbench and continues his day's contribution to the build—zoomy-looking headers for the Lycoming, which are styled suspiciously like the headers on a chopper parked outside the shop. The crew members return to their tasks. The riveting hammers resume their clatter. Within 20 minutes, the engine mount has been plasma-cut from the chassis, and work on a new one begun.

1

2

3

1 The *Monster Garage* shop after three build days, and before the first articulated engine mount is scrapped. 2 One of two wing halves gets skinned with sheet aluminum. 3 Jesse checks the car's new custom exhaust system.

JESSE FIRST DECIDED that he wanted to build a flying car at the age of 7. Three decades later, he's getting his chance. It's been an unlikely journey. After an unruly youth in Long Beach and a short stint as a rock-band bodyguard, Jesse settled into a career building custom choppers and hot rods. Within the past few years his Long Beach-based West Coast Choppers has become the boutique chopper shop for pro sports figures and Hollywood personalities, with bikes costing well into six figures. The Discovery Channel came calling in 2001. Reality shows featuring battling robots and junkyard engineering had become surprisingly successful on cable, and the channel was looking for a host who could up the mechanical ante and appeal to a younger, more heavily tattooed audience.

Monster Garage became an immediate hit, propelled both by Jesse's cable-ready intensity and by the show's inherently dramatic format: A crew of maverick mechanics tries to beat the clock—and the temptation to clock each other

GETTING AIR

There are more challenges to building a flying car than bolting on a pair of wings. The Esperante is heavy by airplane standards. The wheels are in the wrong place. The aircraft needs controls. Here's how they got it off the ground.

Rotation

Airplanes have their main gear just to the rear of their aft center of gravity (CG) limit. When the plane accelerates to takeoff speed, the pilot raises the nose (rotates) to generate more lift, and the plane lifts off. The flying car's rear wheels are too far aft of the CG—it's not possible to make the car rotate around the rear wheels.

Airfoil

Engineer Neal Willford designed a custom airfoil shape that generates more lift at a smaller angle of attack so the flying car won't need to rotate. Jesse won't have to pull back hard on the stick—which might make him overcontrol and go too high.

More Power

The flying car has two engines: the V8 Ford engine that's coupled to the rear wheels, and the Lycoming that drives the pusher prop. The V8 accelerates the heavy (3600 pounds) vehicle to liftoff speed. (A Cessna powered by the same engine weighs less than 2300.) The 320-cu.-in. flat Four Lycoming engine generates about 160 hp at takeoff rpm. That's enough power to keep the flying car flying but not enough to let it climb out of ground effect.

Vertical stabilizer keeps craft aligned into the wind, like a weather vane.

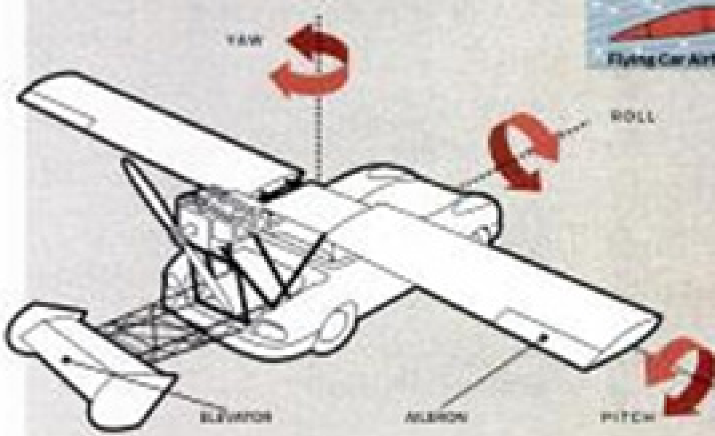
Fuselage constructed of 4130 moly steel tubing carries stabilizers and elevator. Left unskinned to save weight.

Wings are hinged at center, fold up along tail for road use in only 10 minutes.

The Panoz suspension is optimized for high-speed handling, not for soaking up the force of a hard landing—there's not enough suspension travel. The springs were replaced with slightly harder ones, and the tires with slightly higher-profile ones to provide extra ground clearance.

Bernoulli Was Right

Wings generate lift by a simple principle: The airflow over the top of the wing is faster than the airflow under it because of the shape. The faster airflow has lower pressure, and the pressure difference lifts the wing by displacing air from above the wing to below it.



Flight Controls

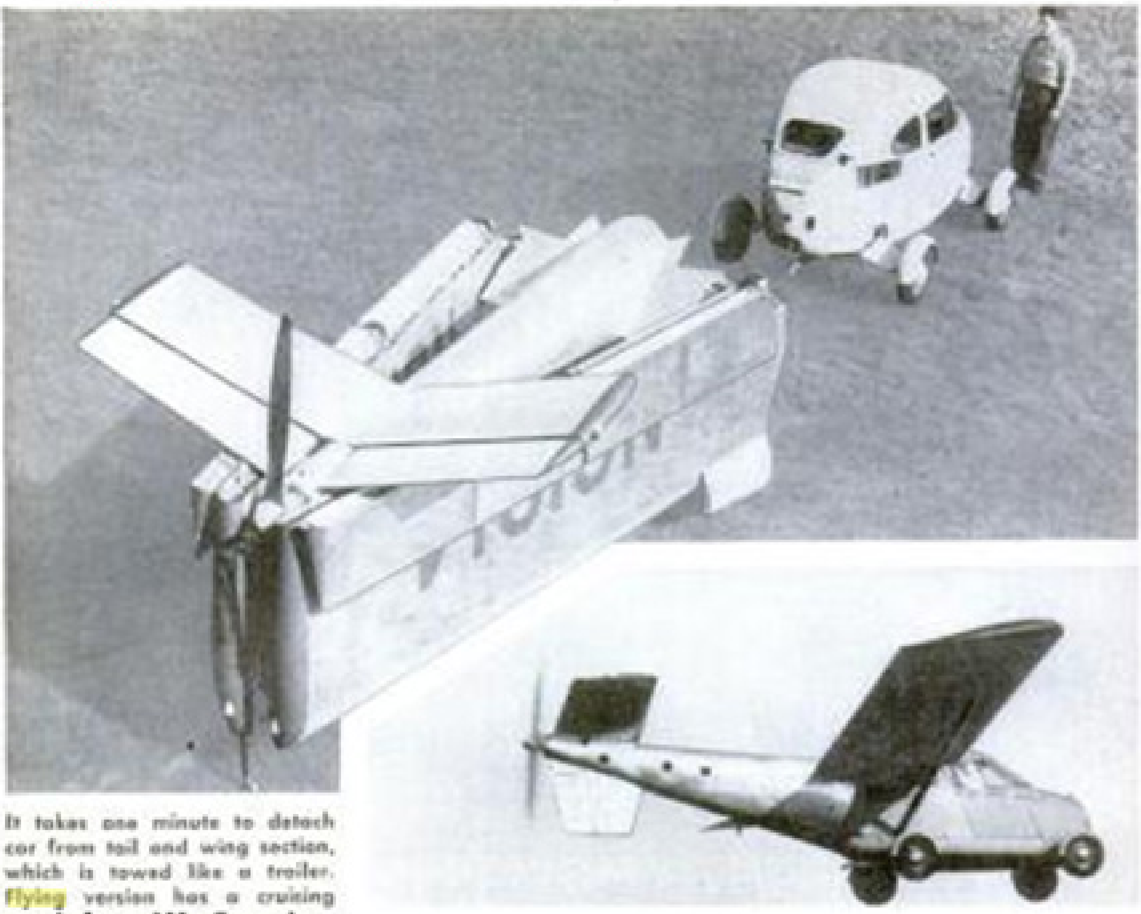
The Wright brothers figured out that aircraft need to be controlled differently than cars—they need to bank into turns as well as go up and down.

PITCH is an up-and-down motion, and it's controlled by a large movable surface on the rear of the plane called the elevator.

ROLL to the left and right is controlled by ailerons on the ends of the wing.

YAW is a left-and-right motion and is controlled by a rudder. The flying car has no rudder, which makes it difficult to control.

January 1951



It takes one minute to detach car from tail and wing section, which is towed like a trailer. Flying version has a cruising speed of over 100 miles an hour

Quick-Change Flying Auto

No tools or special equipment are needed to convert a newly designed flying automobile back to road use. The change-over can be made by one person in a few minutes. Small enough to be kept in a home garage, the flying vehicle has a front-wheel auto drive and a pressure air-cooled rear engine. It is equipped for crosswind landings and is said to be spinproof.

Liquid Nitrogen Pulverizes Tough Materials

Even extremely tough and hard materials can be ground to a powder through a new process which utilizes the cooling properties of liquid nitrogen. In the past, some tough materials were difficult to grind because they became overheated. Now, the material to be ground is first sprayed with liquid nitrogen, which cools it to an extremely low temperature where the material becomes fragile. It then passes through a pulverizing mill. Nitrogen is an inert element and therefore does not react with the materials being pulverized.

¶ There are approximately 59,300,000 registered automobile drivers in the U. S., according to the Automobile Manufacturers Association.