

**DRIVING*****DRIVING; Lots of Zoom, With Batteries*****By Chris Dixon**

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"O.K., you hit this button," says Alan Cocconi, pointing to a control on a little G-force meter attached to his dashboard. "Then hold down the brake really hard. Push on it with all your might. When it says 'Go,' let off the brake and hold on."

With that he steps out of the car. A flat, straight half-mile of asphalt is dead ahead; alongside stretches the runway of Brackett Field Airport east of Los Angeles. With the throttle and brake pedals fully pressed, the bright yellow sports car shudders with power -- but rather than the roar of a caged Lamborghini, the only sound is a muffled whine. Though the whine becomes only marginally louder when the brakes are released, everything else changes as the car lunges forward in a jaw-dropping, stomach-clenching and near-terrifying blur. In 3.7 seconds, it's all over. That's the time it has taken for this little electric sports car, the Tzero by AC Propulsion, to reach 60 miles per hour. And its only power is from a simple array of lithium-ion laptop computer batteries.

Few street-legal automobiles are capable of running to 60 m.p.h. in under four seconds, and it's a safe bet that the Tzero is the only electric-powered car that can. The founders of AC Propulsion, based in San Dimas in the suburbs east of Los Angeles, seem to think that the lithium-ion batteries have led them to the holy grail of electric motoring: range and performance in one package. This is, however, after the major automakers have cast aside ideas of all-electric vehicles and turned their attention to hybrids and fuel cells.

Thunderously fast but whisper quiet, the rear-wheel-drive Tzero began life in the late 1990's as a showcase for AC Propulsion's high-revving AC 150 drive system. A 220-horsepower street-legal racer, the car was powered by a series of deep-cycle automotive lead acid batteries. With 1,250 pounds of batteries on board, the original car was good for 4.1-second zero-to-60 times with a top speed of 90 m.p.h. and a range of 80 to 90 miles.

Last month, however, AC Propulsion unveiled the latest version of the car, now powered by 6,800 lightweight lithium-ion laptop computer batteries. With these batteries -- and an increased top speed -- the Tzero weighs 700 pounds less and the company says it will run up to 300 miles on a single charge -- which requires a few hours plugged into a 220-volt outlet like the ones many households have for clothes dryers. It can also be recharged at a 110-volt outlet, but it takes about three times as long.

The car, priced at \$220,000, is available only directly from AC Propulsion and has not yet met federal safety regulations. The company says, though, that it is legal for street use when registered as a "special construction vehicle," which is the way homemade and kit-built cars are registered. The Tzero at the speedway had a California license plate and had been driven to the track. So far, the company said, deposits have been made for eight cars with the lithium-ion system. (Two earlier versions, with lead acid batteries, were sold for private use.)

What will a Tzero buyer get?

A car that, from zero to 100 and through the quarter mile, will run with, or beat, the \$281,000 Lamborghini Murciélago, the \$224,000 Ferrari 575M Maranello or the \$440,000 Porsche Carrera GT. And do it cleanly and quietly. However, with the single-gear Tzero's engine limited to just over 100 m.p.h. at 13,300 r.p.m.'s, it will never win an oval-track race against those supercars. But its developers are betting that the car's power and range will generate renewed interest not only in their company's offerings, but in electric cars in general.

The Tzero is the brainchild of Mr. Cocconi, an engineer, and Tom Gage, a former race car driver and an engineer. Mr. Cocconi founded AC Propulsion just over a decade ago after having worked for General Motors as a founding engineer on the company's Saturn EV1 electric car project. Mr. Cocconi said he decided to go out on his own after G.M. decided to build the car. "I didn't want to be a part of the big G.M. machine," he said. "About a month afterward, I thought about upgraded chargers and what techniques were possible and I started AC Propulsion." With that, he ripped the engine and transmission out of a Honda CRX, and set to work devising his own drive system. Today, 160,000 miles later, he said, that Honda is still humming.

Mr. Gage met Mr. Cocconi while working as an automotive industry consultant on electric vehicles in the early 90's. "When I interviewed Alan," Mr. Gage said, "it became obvious that not only did he clearly know what he was talking about, but he was doing something about it. I drove a prototype of his and was blown away." A year later, he said, the consulting work dried up and he joined AC Propulsion.

The company's early days coincided with California's Zero Emissions Vehicle or Z.E.V. mandate. When it appeared that automakers would be required to sell a substantial number of Z.E.V.'s, manufacturers were a primary customer for AC Propulsion's systems for testing and evaluation. When the mandate was challenged by manufacturers in 2001, Mr. Cocconi said, sales dried up. Today the company sells its \$25,000 E.V. conversions to private enthusiasts and to bus companies. Mr. Gage said that the lithium-ion setup, and plans to offer a conversion system for Toyota's Scion xB, could chart a new course for a company that today has only 12 full-time employees.

M R. GAGE said that he and Mr. Cocconi realized that they could never produce a car with the economies of scale of a Honda or a Toyota. "That's how the Tzero was born; it's a niche," Mr. Gage said. "We knew it would be expensive because it was hand-built in-house, but it would justify its price because it would have outstanding performance." The Tzero was based on a mid-90's car called the Sportech that was designed by several Detroit engineers and powered by a motorcycle engine. According to Mr. Cocconi, only five were made. AC Propulsion modified the Sportech's bare-bones design with a beefier frame, doors, windows and a roof.

A few weeks ago, AC Propulsion took the revamped Tzero to the California Speedway in Fontana, 20 miles east of Los Angeles. Under the baking sun, the first tests were run alongside a Chrysler Crossfire and a Scion xA that Mark Vaughn, a senior editor of AutoWeek magazine, had brought to track test. Also on hand was Tony Shalhoub, the star of the USA Network series "Monk." Mr. Shalhoub, who described himself as the avid owner of a Toyota RAV4 EV and was tipped off to the demonstration by a Toyota dealer, said that he wanted to see what the Tzero would do.

On the first day of testing the new lithium-ion system, the Tzero's traction control and handling were not calibrated to the car's 700-pound lighter weight. Thus the Tzero could only muster a 4.1-second zero-to-60 time because its rear tires kept breaking free. In the slalom, the Tzero ran only slightly faster than the Mercedes-engineered Crossfire, but Mr. Vaughn said that with the suspension properly calibrated and stickier tires, it could have run faster.

"It's pretty cool," Mr. Vaughn said. "With a gas car you have to play around with engine power and adjust where you engage the clutch. With this thing, you just step on the pedal, light the fuse and keep steering."

Next, the Tzero and Mr. Shalhoub disappeared up the test track, with an occasional smoking of the tires. He came back, zigzagging on the way, and compared the car's acceleration to a ride he had taken in a Navy Blue Angel jet. "I thought I was at the top end," he said. "Then I

stepped on it a little more and it doubled in speed. It's terrifying, but it actually handles beautifully."

Mr. Vaughn, who described AC Propulsion as "the most legitimate of all electric-auto makers," said that the company faced an uphill battle even with the Tzero's 300-mile range and a promised 190-mile range in a converted Scion xB, a small, boxy four-door wagon that is considerably heavier than the Tzero. "For AC Propulsion," he said, "the Tzero alone might not be the secret. Even if they get a sugar daddy, that's not enough. They need to get a Honda or Toyota to say, 'Yeah, we want it.' If they're going to offer conversions for xB's, which makes sense, that would offer a lot."

Last week, in preparation for a pending clean-car challenge called the Michelin Challenge Bibendum, next Tuesday to Thursday in Sonoma, Mr. Cocconi was again ready to put the Tzero through its paces. With suspension and traction bugs ironed out, the Tzero ran the 0-60 test that yielded 3.7 seconds. It was also ready for a drive along the stunning Glendora Mountain road in the Angeles National Forest. With ample opportunity to run in the real world, the car was a wonder to behold. Because the car recharges its batteries when the throttle is released -- slowing sharply as energy is recaptured -- it can be driven hard using only the accelerator pedal. Also, if the car detects a turn with more than half a G-force, it eases the rear-wheel regenerative braking to prevent slides. After a driver has had a few minutes to get used to the system, there comes a wonderful sense of limitless, fluid power as the car quietly wails, dodges, thrusts and parries on the mountain road.

"That's unique with an electric," Mr. Cocconi said. "Whether you accelerate or decelerate, you're always in the right gear." He said that no traditional stick shift could do that.

In between the beautiful vistas and the twisting road, it was fascinating to catch glimpses of the ammeter, the gauge that shows the power being consumed. While it goes into negative territory on uphill acceleration, it flies the other way on downhills, charging the batteries. Mr. Cocconi said that because of the up-and-down nature of mountain roads, and relatively slow speeds, this is where the car is most efficient. Still, he said, he drove it 250 miles last week on the freeway, and the car's computer indicated it could have gone at least another 40.

At the end of a hard drive, including five scorching zero-to-60 runs, the car had traveled 57 miles and used only 9,900 of the 50,000 watt-hours in its batteries, costing less than the price of two gallons of gasoline. "These batteries," Mr. Cocconi said, "they're really pretty magical."