



Pasadena: 9 a.m., August 26—Wally Rippel gets a smooth start and hearty sendoff, and the Caltech car is on its way.

CAMBRIDGE OR BUST PASADENA OR BUST

Both teams in the Great Electric Car Race made it--and busted too.

For the last several years a persevering undergraduate has been Caltech's resident promoter of electric automobiles. Wally Rippel, '68, converted his 1958 Volkswagen bus to electric propulsion and drove it fumelessly around town in an attempt, he said again and again, to demonstrate an al-

ternative to smog. His listeners smiled indulgently.

Now the smog remains and Rippel is gone, but the manner of his departure hinted that electric propulsion may not be such a frivolous business after all.

At 9 p.m. PDT on August 26 the electri-

fied VW, with Rippel and some classmates, took off for MIT in Cambridge, Mass. At the same moment a group of MIT students started off for Caltech in an electrified 1968 Corvair. The event was the result of a challenge to race electric cars across the country issued in January to MIT students by Rippel.

Both sides figured to take up to 5 days for the trip. Neither did. The MIT car made it to Pasadena 7½ days after the start, and Caltech hummed into Cambridge 37 hours and 20 minutes after that. But by the time the judges finished assessing penalties for such activities as towing, recharging with a portable generator between official charging stations, and replacing parts, the tortoise had once more beaten the hare. Caltech's corrected time of 210 hours was 30 minutes less than MIT's.

Cost of the electricity used was about \$25 for each car, but before you head for Chicago in an electric runabout, consider a few of the logistics associated with the Great Electric Car Race:

- ▶ 54 charging stations set up in advance by Electric Fuel Propulsion Company of Ann Arbor, Michigan, in cooperation with local utility companies along the route (US 66, the Indiana-Ohio-New York-Massachusetts Turnpikes). Charge times ranged from 45 to 60 minutes.
- ▶ One or more "chase" cars supplied by each entry, carrying additional crew members (6 total for Caltech; 13 for MIT) and, in Caltech's case, towing a portable 220-volt generator.
- ▶ Ice for cooling batteries (50 pounds for Caltech, 350 for MIT) at most stops.

In addition, for purposes of timing the entries (and also to carry additional spare parts and personal gear), each team had a judge and a station wagon supplied by Machine Design magazine.

MIT's entry, developed more or less by their electrical engineering department, had a car supplied by General Motors and \$20,000 worth of batteries supplied by Gul-ton Industries. It was considerably more sophisticated than Caltech's car, which

really belonged to Rippel. The car and the batteries—\$600 worth—are his, although he had received several donations of equipment and help from Caltech and outside enterprises as the race neared.

But MIT's sophisticated car was a laboratory model and had never been driven until shortly before the race. Reports from Cambridge were that the car would go faster than Caltech's and recharge in less time. Rippel, admitting that MIT had an edge in equipment, figured he would have a reliability edge because of simpler design and proven components.

Ultimately, that turned out to be the case, although once the race started the gremlins in both vehicles emerged.

Members of the MIT crew—who had a notion of what they might face after a last-minute trial run that almost burned up their set of nickel-cadmium batteries—had to tow their car about 250 of the first 500 miles. They had a constant heat problem, but they partially solved it by cramming the battery areas full of ice at each charging station.

Caltech's problems were less spectacular, but nonetheless vexing. The main problem, too, was heat, especially while recharging the lead-cobalt batteries. It forced the Caltech crew to slow down the recharging rate at first, wasting driving time.



Between Needles, Calif., and Kingman, Ariz.: VW buses have one important advantage over Corvairs—room to snooze.

To Caltech crew member Dick Rubinstein, '69, riding in the chase car, the trip went like this:

“ I was a little uneasy when we started out, not knowing how things would go or what was going to happen. In the first stretch we found newsmen following us, even photographing us from bridges. There were so many things happening at every turn we really couldn't pay attention to everything.

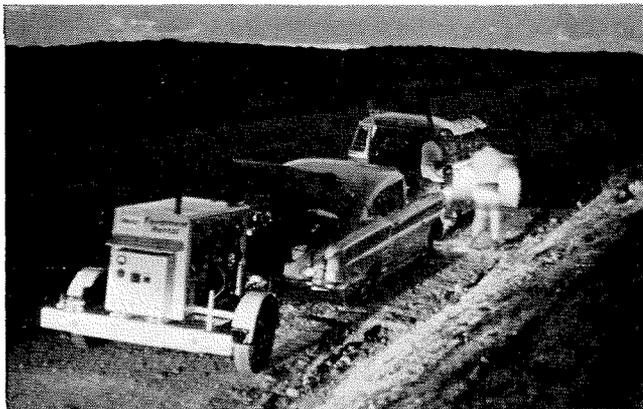
Our first charge stop—in San Bernardino—was a little awkward. The Edison Co. crew didn't know what to expect of us, and we didn't know what to expect from them, but that smoothed out after a few charge points.

Our next charging point, the Green Tree Inn at Victorville, went smoothly. We were able to eat and relax a little, while the batteries charged. We were having trouble with the batteries overheating, and we had this trouble through most of the first half of the race.

The people we met at these charge points were wonderful. We usually attracted small crowds, and everybody had questions. We had fun talking to the people, but we also had to chase around to eat and call ahead to other charge points.

I might add that through the desert we had more trouble with Andy Joseph's [70] car overheating than we did with the electric car. But, it's a 1958 Chevy, and after all, it was towing that heavy portable generator.

After stops at Newberry and Amboy we did all right. I remember the service station attendant at Amboy. He thought it was all a joke and asked: 'What do you need an electric car for, anyway? What air pollution?'



Between Kingman and Seligman, Ariz.: Sunrise on the desert finds the portable generator reviving the batteries.

I remember waking up about six miles from Needles. Andy was on the two-way radio with Wally, and Wally said he only had about 90 seconds worth of power left, so get ready to use the generator. We didn't know how much farther the car would go, and it was slowing down. But after a minute—or maybe a little more—we rode over the crest of a hill, and it was downhill all the way to Needles. Wally used the downgrade to recharge the batteries with the motor, and we got into Needles with power to spare.

Meanwhile the MIT car was reported to have been towed to its first few charge points. The batteries didn't seem to hold enough power. Towing was allowed, but with a penalty of five minutes per mile according to the race rules.

We had to run around a little in Needles to find the charge point, but when we arrived, people there gave us soft drinks and made us welcome. I had to stop awhile and be interviewed on the phone by a wire-service reporter.

I caught some more sleep between Needles and Kingman. On the way we had to use the portable generator for the first time—a half-hour penalty. In Kingman we pulled up behind a school to the recharging point. It was after midnight, and while two of us were walking to a gas station, we were stopped by the police. They wanted to know what we were doing walking around town at that hour. We explained.

The doctor assured him it wasn't mumps.

Everybody was tired already, but from Kingman we moved on to Seligman. We had to stop twice to use the generator, but that was our fault. We thought we had enough power in the batteries to make it after the partial recharging, but we didn't.

Before we reached Seligman, Pat Silverthorne [71] mentioned he wasn't feeling well. He said he had a swelling in his neck and cheeks but that the doctor had assured him it wasn't mumps. It was mumps. Sam Barnes, the fellow from *Machine Design* magazine who came along to judge our performance, drove Pat to the town of Williams to see a doctor, then on to Flagstaff. That's the last we saw of Sam Barnes for more than a day.

*About mid-morning,
disaster struck.*

Well, anyway, just east of Seligman, about mid-morning, disaster struck. Wally was driving down a hill with the car in second gear, trying to put a little more charge into the batteries. From my point of view—I was half asleep at that point—we were coming down the hill and there was a very loud thud. The electric car slowed down abruptly, stopped, and somebody got out and ran around back. Wally said, 'I think we blew the motor.'

So we sat there, thinking. Then Wally and Andy got in the chase car and drove back to Seligman—about 10 miles—and got on the phone to Robert Aronson of the Electric Fuel Propulsion Co. in Michigan. Andy came back alone. Wally was still in Seligman calling everybody he could, and Andy went ahead to drop the portable generator at Ashfork. We took the motor out of the electric car when he came back.

It was a little hard trying to figure out how to get that 200-pound motor out gently, but when we did, it only took about ten minutes. George Swartz [a former classmate of Rippel's at Caltech] sort of caught it with his knees as we supported it by ropes.

Lots of people came by, too. Some stopped, wanting to see how we were doing. Of course we had plenty of time to talk now.

Andy, George, and I went back to Seligman



Winslow, Arizona: This charge station isn't as elegant as some, but amps are amps no matter how they're delivered.

where Wally was. Ron Gremban ['69] stayed with the car. Wally had finished phoning and found out we would get another motor, that it was being flown to Phoenix, and we could pick it up there.

Things weren't going much better for the MIT crew, either. They reported in just a few miles east of Buffalo, N.Y., where they were stalled after burning up a transformer. They were delayed seven hours, but after making repairs they began making good time across Ohio.

Repairs took a little longer for the Caltech machine, since the new motor was being flown all the way from New York.

We all sat down in Seligman and had a beer or two, and at one point Wally stepped outside to watch a train go by—he has a fascination with trains. Then we decided to go on to Flagstaff, leaving Ron with the electric car.

We were looking for Sam Barnes, too, since all our clothes and other stuff were in his car. We all looked grubby, but went in a restaurant anyway and had a good steak dinner. Then we found a place to stay—and we washed some clothes in the motel.

We all got a little sleep, but about 11 p.m. Andy and I took off for Phoenix to meet the plane. I slept most of the way, but when we got there we found it was a case of hurry-up-and-wait because the plane didn't arrive until 3:30 a.m., and it was another hour and a half before we got the motor. We carted it to Flagstaff, then slept while the others put the adaptor plate on it and took it to Seligman.



East of Seligman: George Swartz tries to decide how to remove the burned-out motor from Caltech's crippled car.



Albuquerque: With the motor catastrophe behind them, the Caltech crew enjoys the attention of early-morning pedestrians.

They must have found Sam somewhere, because he woke me up at the motel and we took off for Ashfork to meet the electric car. It sure was nice to see that thing pulling into town under its own power.

Apparently they had no trouble getting the motor in the car, especially since they were able to borrow a transmission jack to help.

From there on the going got smoother. We were still pretty disorganized, with everybody's stuff in the wrong places, but we soon worked all that out. We met Pat Silverthorne [the one with the mumps] in Flagstaff, where he was recuperating with an aunt who lives there.

Everything went all right through Winslow, Ariz., and Sanders, Ariz., but we had a minor problem in Gallup, N.M. Everything was fine with the electric car, but we had an eye problem in ours. Andy, who wears contact lenses, was getting ready to drive and was putting his eyes in when one lens disappeared. We spent about 40 minutes searching for it with no luck. After we gave up, he looked in his lens case, and there it was, where it had fallen.

Our next recharging station was in Grants, N.M.,

where the power company people had coffee and donuts waiting for us. They were talkative and friendly.

Getting into Albuquerque was an easy trip. It was sort of downhill going in, and our reception in Albuquerque was something else. They had the recharging station roped off on the sidewalk, a big sign was up, and they had a girl dressed up as Reddy Kilowatt. They provided us with showers, bought us breakfast, and gave us a red carpet welcome. In all we probably stayed in Albuquerque about a half an hour longer than we should have.

For MIT, the problems were compounding. The car caught fire when it was being recharged at Elkhart, Indiana. It was put out quickly, but damage was worse than first estimated, and the delay was more than 10 hours.

The MIT car was next reported in the area of Springfield, Ill., where they were having problems with the motor overheating. The method they chose for cooling it was to pour water on it.

Wally lightened the load by having Ron and George walk.

We soon ran into a great glob of traffic on the way out of Albuquerque. It turned out they were blasting on the road ahead, and we had to sit there at least 45 minutes. We spent the time discussing some method for cooling down the batteries during the charging process.

Our next recharging point was Clines Corners, N.M., but before we got there, Wally pulled over, complaining that a brake or something seemed to be dragging. We jacked the car up and checked, but nothing was wrong. We were afraid we didn't have enough battery power left to make Clines Corners, so Wally lightened the load by having Ron and George walk. It was only about two miles, but the car made it and it was a nice walk for them.

Along about the time we reached Santa Rosa, N.M., the weather started looking nasty. It became very, very windy in Santa Rosa, so windy we could hardly walk.

We had to use our portable generator before we got to Tucumcari, N.M. Also, we ran into a heavy rainstorm going into Tucumcari, and where we were charging, we found the streets were somewhat flooded. After Tucumcari, it got so that if you weren't driving you were sleeping.

Amarillo became another trouble spot for us. Somehow, when we were hooking up the lines, we got out of phase and blew out three diodes. That presented no problem except that Sam Barnes—who



McLean, Texas: 50 pounds of ice cool overheating batteries.

was driving without a relief driver since Pat Silverthorne got the mumps—couldn't be found. He was making a practice of driving ahead a stop or two to catch some sleep as we drove. We called everywhere but couldn't find him, and we even had the Texas Highway Patrol out looking. We found we could get the new diodes in Dallas, but boy, that was a long way off. Finally Sam got our message and came back. We charged up, ate breakfast, and took off again—after a delay of three or four hours. The weather was still kind of damp, too.

We finally solved our battery overheating problem in McLean, Tex. While the car was charging, I went into town to buy some rubber tubing and a rubber syringe bulb. We got some small ice cubes and put them on the batteries, then used the tubing to siphon the water out of the battery enclosure. We used the syringe bulb to start the siphon. That was our handy-dandy cooling system, for which I blushingly accept credit.

It was also in McLean that a Texan came to our rescue. One of the bystanders walked off, then returned bearing a nice, ice-cold 50-pound watermelon. It was home-grown, and the best I've ever tasted.

MIT's recharging procedure might scare someone out of driving an electric car.

At Erick, Okla., we sent a telegram ahead to the MIT crew asking if they'd agree to stop awhile in Oklahoma City for a chat and rest, maybe something like 12 hours. But we actually met at Weatherford, Okla., the charge point west of Oklahoma City.

We'd finished charging at Weatherford when they were towed in. We waited there a couple of hours, and we saw their recharging procedure. It was enough to scare someone out of driving an electric car. It was amazing; there were probably 12 people involved, girls rushing around, dropping big bags of ice on the ground, everything helter-skelter, confused. And they refused to stop to talk. They took off right after recharging.

After Oklahoma City we got the batteries straightened out very well. We charged them slowly for four hours and got everything back in phase. This made it much smoother than it had been.

The charge point at Tulsa was near a big motel called the Camelot Inn. They really fussed over us



Pasadena: The MIT car is towed across the line on Labor Day, and the crew is deluged by reporters and TV crews.

there and gave us a room in the motel to take showers. We probably lost more time on this kind of thing than for any other reason, but it was great.

Going into East St. Louis, Ill., we got lost. We ended up waiting nearly an hour for somebody from the power company to find us and lead us to the charge point. They had 350 pounds of ice ready when we got there, but we only needed 50 pounds.

Monday morning—a week after we left Caltech—we were in Elkhart, Ind., and we learned that Pat

Silverthorne was feeling better and would meet us in Cleveland. Of course in Cleveland [headquarters of *Machine Design* magazine] there were all kinds of people out to greet us. We met the race judges and the members of Sam Barnes' family. We also learned the MIT car was in California.

The MIT car was indeed in California. But here the problems multiplied. Crew members didn't like the charging setup at Newberry, so they elected to tow part of the way to the next point, Victorville. The driver, however, neglected to take the car out of low gear while being towed at 65 mph. The electric motor, turning over too fast, disintegrated.

The MIT crew notified the judges and others that they intended to tow the car directly to Caltech, bypassing the last two charge points. They arrived at 3:26 p.m. and crossed the finish line.

After Cleveland the stops were pretty smooth, and many looked just alike. The only place we encountered any problem was at the last stop before Cambridge. I called ahead to the power dispatcher at Charlton, Mass., but he almost refused to accept my call. He finally took the call but said it wouldn't



Cambridge: The eventual winners get the checkered flag on Wednesday morning, nearly nine days after they left Pasadena.



Cambridge: The weary Caltech crew collects some laurels, including congratulations from MIT President Howard Johnson.

do any good because he didn't want to call anybody out to work on overtime just to charge our batteries. I called Bob Byers, the public relations man at MIT, who called the power company, and they assured us we'd get recharged.

But it didn't work out that way. When we arrived, we found the point was six miles off the highway instead of the short distance we were told, and then we found he couldn't supply three-phase power. We ended up charging the batteries with the portable generator anyway.

Before we reached this last charge point, we had been met by an escort committee from MIT, and they led us right in to the campus. That was the end of our long, weary journey. ♪

The boys were greeted on arrival—7:46 a.m. Wednesday—by MIT President Howard Johnson, then attended a news conference that afternoon and a banquet that night sponsored by Caltech alumni. By the time of the banquet they knew they'd won the race by half an hour.

The following night—at the Tavern-on-the-Green restaurant in New York's Central Park—crew members of both teams were honored at a victory dinner. The celebration was arranged by Caltech alumnus Victor Wouk, PhD '42, of Gulton Industries, which had provided equipment (notably MIT's

nickel-cadmium batteries) and advice to both teams. Wally Rippel was presented with a trophy for the "1968 National Electric Car Competition" given by the Edison Electric Institute and Reddy Kilowatt, Inc; he insisted it belonged not to him, but to Caltech, and had it forwarded to Pasadena.

By Saturday both cars (Caltech's having been trucked from Cambridge, MIT's flown from San Bernardino) were on display at the Smithsonian Institution in Washington, D.C., highlighting a "Cars of the Future" exhibit sponsored by the U.S. Department of Transportation.

Wally Rippel has gone on to Cornell for graduate work, but Ron Gremban, one of the co-drivers, is already making plans for another race next summer. Electric Fuel Propulsion Co. has offered improved lead-cobalt batteries that will recharge faster and run as many as 250 miles between charges, and a new motor capable of speeds up to 90 mph. What Gremban still lacks is a car—preferably a VW squareback sedan—in which to install them.

This year's race seemed, in some ways, to be more a test of endurance than performance. A second race might reverse that emphasis and make for an even more exciting contest. □