Is the electric automobile the car of the future?

Integrated transportation systems are being developed for the 21st century. Carol White reports on a Japanese design for an electric car which would be magnetically levitated.

With the imposition of the most stringent clean air emission standards in the world by the state of California, the electrically powered car is coming into its own. By the year 1998, according to present law, 2% of all cars sold in California must have zero emissions, and by the year 2001, the figure is to be 5%.

This legislation has acted as a major stimulus for the development of electric cars, both in the United States and in Japan. It is an open question whether such an artificial stimulus to consumer demand will pay off, or whether the legislation will have to be rescinded when it proves to be unrealistic. In the main, the present race to develop the electric car may involve a massive research and development effort, but it will not lead to increases in productivity, by revolutionizing methods of production or by improving the ease and speed of transportation for the consumer. In fact, insofar as investment is diverted from major infrastructure development, the reverse will be the case.

Smog is a serious problem in Los Angeles, but the main contributing factor to the man-made part of the problem is the failure to develop an adequate mass transit system which would free commuters from dependence upon the automobile. The same is true for the disproportionate amount of freight now shipped by truck, rather than by rail or a combination of rail and truck.

In fact, the electric car can really only come into its own as a sensible alternative to combustion-powered vehicles under circumstances where it is used to commute to and from trains, or perhaps where the car itself can take on the function of a train (or trolley car) on specially run highways. Such special highways are being designed in northern California, and they are a major feature of a unique electric car now under development in Japan—the Equos.

An electric car by 1998

General Motors and Nissan are front-runners in developing a competitive electric car which can be on the market by 1998. A key element in the competitive sweepstakes is finding a battery which can be rapidly recharged, and which which will allow the car to travel for more than 100 miles (at normal highway speeds) without the need for recharging. Since these batteries are heavy, one pathway for higher performance from the batteries is to reduce the weight of the car itself below that of today's compact car. This, however, creates a safety problem in the event of collision, and it also limits the carrying capacity of the car.

Another issue which the environmental lobby has failed to address, is the fact that, in the United States at least, half of the electric plants are presently coal-fired. The phase-out of nuclear power, a clean energy source, means that any widespread use of the electric car will place demands on the existing electric grid beyond its capacity, and will necessitate bringing more "polluting" power stations on line. Such is the insanity of an energy policy governed by environmentalists who are operating on their own malthusian agenda.

While hydrogen-powered vehicles can theoretically meet these emission standards and hydrogen fuel cells are an upcoming technology to replace the battery, the battery-run electric car is the more promising candidate in the immediate future. Many problems remain to be solved before electric

A prototype of the Japanese Equos battery-run electric car. Among other unique features, the car's wheels are independently controlled, so that they can turn in parallel to allow the driver to slide deftly into a parking place.

vehicles of the future become competitive with the combustion engine-powered cars of today. This is true whether we use the criterion of performance, safety, or cost.

Designing for maglev systems

The most exciting, integrated conception for the electric car of the future which I have come across, is the idea of designing an electric car of today which could become the magnetically levitated car of tomorrow. Such a car would effectively function as a magnetically levitated train, or trolley car, under highway conditions of driving, where it could travel at extremely high speeds in complete safety, and yet offer the driver the option of door-to-door travel in one vehicle.

Perhaps under the present ugly conditions of trade war being stimulated by the failing U.S. automobile industry, such an advanced transportation system will remain only a dream, since its scope demands a visionary approach on the part of an international team of developers. Surely, if this is so, the United States will have lost yet another opportunity to move into the 21st century with the kind of advances in technology which would guarantee a bright economic future for generations to come.

On Jan. 27, I interviewed a group of Japan's leading automobile designers and engineers, including Mr. Shuzo Moroto, chairman of Aisin AW Co., Ltd, and Mr. Koji Kobayashi, Aisin's director of Research and Development Center Electric and Engineering Department, and Mr. Mutsumi Kawamoto, the manager of the Horse Research Section of Equos-Research Co., Ltd. The two companies, Aisin and Equos Research, are collaborating to produce the electric car of the future. Aisin has around 40% of the Japanese automobile transmission market, and it was they who in 1977 perfected the overdrive system of automatic transmission now a feature of all cars.

Meeting the top corporate executives of Aisin and the Equos Research Corp. was really an eye-opener. They embodied qualities which were typical of American corporate leaders particularly during the first half of the 20th century, but which have now become virtually obsolete. In the most recent past, one would look to the men who built the aerospace industry and developed NASA, for a similar quality of vision.

I was reminded, in talking to these Japanese industry leaders, of an America now unfortunately receding in memory, when men such as Henry Ford led the U.S. automobile industry, and the model T brought rural America into the modern age. Along with other towering engineers, such as Thomas Alva Edison and the Wright brothers, Ford was the kind of far-sighted company president who put America on the map as an industrial giant, while today, American corporate presidents like Lee Iacocca pride themselves on being financial managers. Where Detroit was once synonymous with the automobile, today we have the pathetic performance of Iacocca and his cronies attacking the Japanese because they produce cars which Americans prefer to buy.

American industrial leaders of the caliber of Ford or Edison symbolize the kind of greatness which up until very recently characterized America. They had a kind of expansive optimism which fostered technological progress, and, with this, a series of values clustered around the notion of making the world a better place for all children.

Equos, a new concept for the automobile

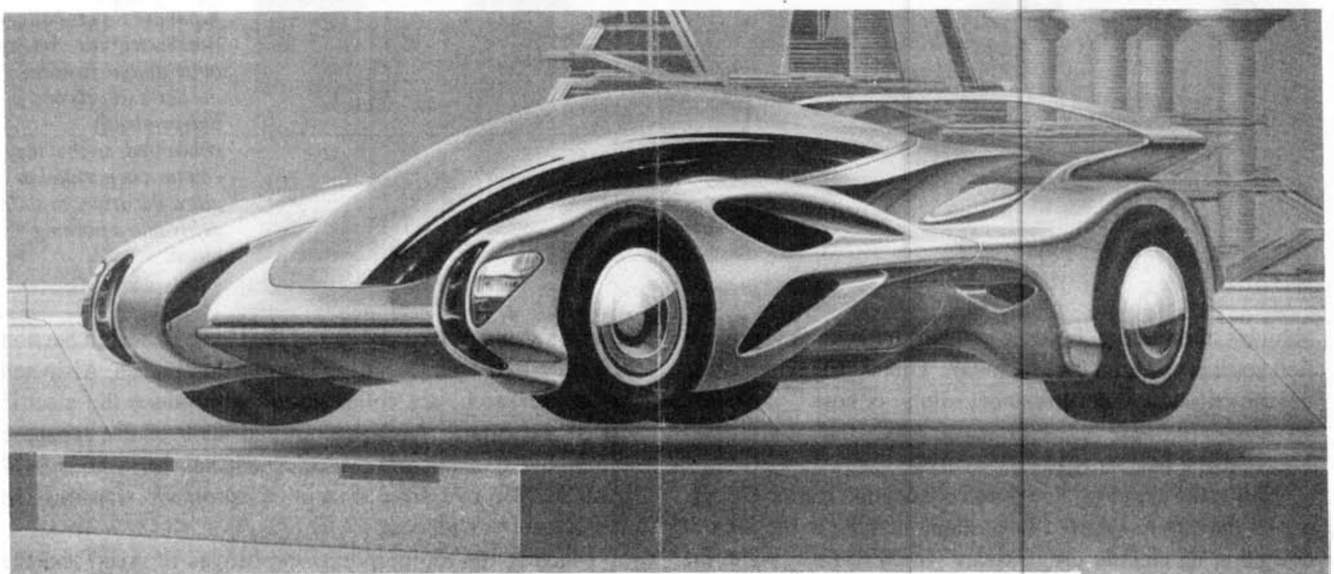
I began my interview by asking whether their commitment to the Equos design was created by the opening of a new market for electric cars because of the stringent environmental regulatory standards set in California. The answer which I received from Mr. Moroto surprised and delighted me.

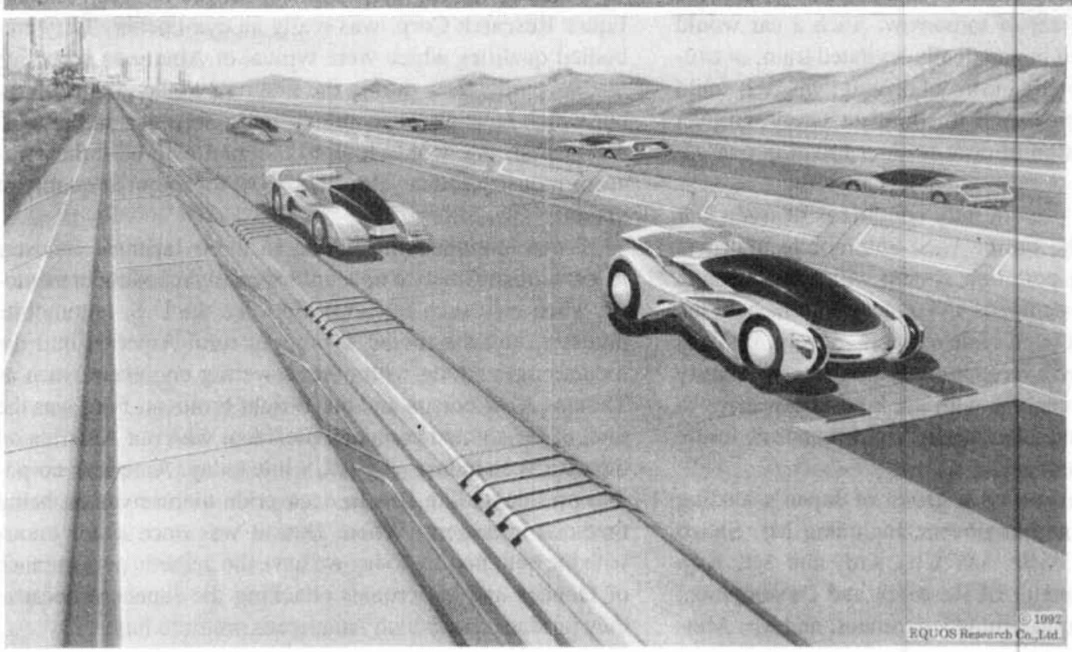
"No," he said, "this is not the way we look at things. We believe that we must always go beyond considerations involved with meeting particular government regulations. We can only accomplish our task by looking beyond any set of given regulations, and seeing how the car we hope to build may transform transportation in the 21st century."

He continued by distinguishing between the regulations which had to be met and the specifications which they themselves considered primary in order to design a car for the future. "We ourselves set our own standards for the development of the electric car," he said.

Still, I pursued the question of whether there would be a market now for the car, were it not for the new clean air standards. "Would you otherwise have poured resources into developing the electric automobile at this time?" I asked.

Moroto pointed to the potential limitations of oil, to ex-





Artist's conception of the automobiles of the future. The Equos company is developing the concept of adapting magnetically levitated rails to a new design of automobile, which will be able to travel as fast as 500 km per hour (312.5 mph).

plain his own more long-range interest in the question of developing alternative fuels. He and his associates are not convinced that the greenhouse effect will be a serious problem, but they are committed to developing alternative fuels in order to conserve petroleum for use as petrochemicals. They also, of course, operate in a country which is dependent on imported oil. Looking ahead 50 years, he said, he felt that it would certainly be necessary to have developed alternate fuels for automobiles, trucks, and trains.

Autos become trolleys

Moroto is committed to adapting the idea of magnetically levitated rails to an entirely new design of automobile. In Japan, associates of his are involved in planning new magnetically levitated train systems in which the train's cars could also function independently as trucks, so as to have an integrated train-and-trucking freight system. These two concepts, for trains which become trucks and automobiles which become trolleys, are in a sense complementary, although the technologies involved are quite different.

The magnetically levitated car would take an individual from his own door to his final destination, but during the bulk of its trip, it would travel on a special highway on which it would be guided. Since it could travel at speeds as high as 500 kilometers per hour (312.5 miles per hour), it would not be driver-controlled. It would have to be carefully guided because of these high speeds.

The maglev car would also operate under its own power, entering and leaving the special highway at the will of the driver, under his or her direct control. Under these circumstances, it would function like the currently designed Equos, running under battery power, with one essential difference: It would be designed to travel at city speeds of around 25 miles per hour only. Reducing the speed would allow battery weights to be reduced and the time between recharges to be extended.

Infrastructure must be rebuilt and redesigned

Infrastructure development has been a key feature of Lyndon LaRouche's program over the past 12 years. During that period, a diametrically opposite program to that which he proposed has been implemented in the United States, with results which have been disastrous. Air traffic deregulation has led to the bankruptcy of major U.S. airlines, a deterioration in service and, more seriously, in safety standards.

Since 1980, railroads have been cut back by at least 25%, as measured by track length. Railroad employment has been cut by half, which is an indication that fewer trains are running on these tracks. With the shift back to coal production, much of the existing rail capacity is used up in transporting coal. Half of total freight moved is accounted for by coal shipments and the movement of crude oil and refined petroleum products (some of the latter by pipeline).

Bridges are collapsing and highways are in disrepair. Many U.S. ports have been turned into tourist areas, and none of those remaining can handle a vessel in excess of 100,000 tons, which is standard for world shipping.

Trucking now accounts for over 40% of the freight moved in the United States, and rail for only about 18%.

Magnetic levitation technology in Japan

While the United States has lagged behind, the Germans and the Japanese have magnetically levitated train systems ready for commerical development, with Germany presently in the lead. The German Transrapid system has received government approval for commerical operations, and in the first phase it will be used to connect the airports of Cologne-Bonn and Düsseldorf.

Magnetic levitation means that a train can run suspended above the track bed, so that the friction between wheels and road is eliminated.

The Japanese presently have two different magnetic levitation system-designs which are running experimentally. The High Speed Surface Transport system has been developed by Japan Airlines, with the drive provided in the vehicle, not in the guideway. It runs at lower speeds than the mainline Japanese Linear Motor Car (MLU), which uses an electrodynamic levitation system based upon the principle of repulsion. The MLU is scheduled to begin transporting passengers in the densely populated 320-mile-long Tokyo-Nagoya-Osaka corridor by the end of this decade.

The MLU uses superconducting coils which are cooled by liquid helium. These are located on the vehicle and interact with a magnetic field which is generated by induction in the guideway coils. Up to speeds of 62 miles per hour, it operates on wheels.

Magnetic levitation technology developed in Germany operates by a different principle. It operates with ordinary magnets, and does not use wheels. Its support and guidance system operates according to the principle of electromagnetic levitation, based upon the forces of attraction between electromagnets arranged under the floor of the vehicle which are individually controlled, and the ferromagnetic reaction rails installed under the guideway.

The optimistic designers of this new car told me that with proper support, they expect that they could develop such an advanced-design car in only 10 years. A model of the car was presented at the International Superconductor Applications Convention held in San Diego, California on Jan. 29-31.

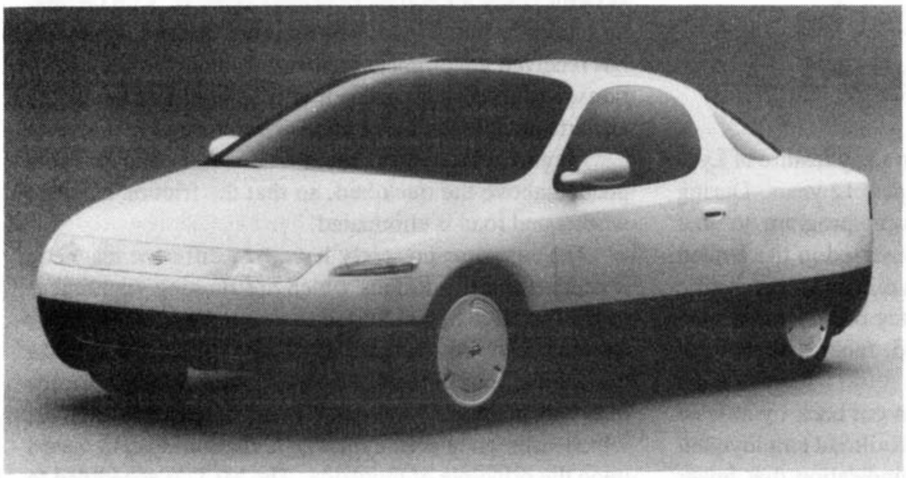
This concept would require development of special roads containing aluminum plates, as well as of advanced automobiles. Their plan would necessitate redesign of the fundamental concept of all magnetically levitated trains—whether of U.S., German, or Japanese design—because the magnets would be located in the rotating wheels of the car, rather than attached to the fixed underbody of a train, and because the drive would emanate from the automobile, not the road. This design is in fact compatible with the Equos design, so that the Equos can be considered as a stepping-stone to a magnetically levitated car. The advantage is the reduction of weight which comes from locating the propulsion device within the wheels. As is the case with Japanese magnetically levitated trains, the design calls for the use of super-cooled magnets. Therefore, the magnetically levitated cars would require miniature refrigerators in order to maintain the temperature of the superconducting magnets.

The location of the magnets in each of the four wheels of the car coheres with the Equos design, which places motors in each of the four wheels of the automobile, rather than using a central battery and a heavy transmission system. The batteries are operated conjointly by a computer located under the hood, and there is an optical communications system between the computer and the motors. There are also American-design cars which place motors in the wheels of the car, either in two or four of the wheels. Thus, in itself, this feature is not unique to the Equos.

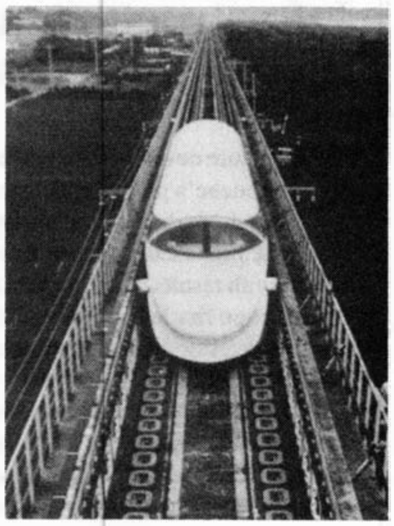
In a sense, the Equos electric-battery car may be called the car of today, or at least of tomorrow, rather than of the next century.

Equos performance

The Equos was imaginatively named after a horse, which has four unrestrained legs, each of which can run free. It has a four-wheel motor drive system, with a small, light-weight



The Nissan Future Electric Vehicle (FEV).



The Linear Motor Car (MLU) of Japan uses an electrodynamic levitation system based upon the principle of repulsion. It moves on supporting wheels up to 62 mph, and is scheduled to begin transporting passengers by the end of this decade.

Shuzo Moroto, chairman of Aisin AW Co., Ltd. His approach is not a pragmatic one, but is to look at how the car his company builds now may transform transportation in the next century.

motor placed in each of its 13-inch wheels. These motors are connected by an optical communications system hooked into a computer. While it optimizes recharging time, the car which I drove could be driven at speeds of 75 miles per hour. It can accelerate 200 meters (one-eighth of a mile) in 12 seconds, and 400 meters in 19 seconds. It was able to travel up a 16.7° slope quite smoothly. It is so carefully designed that brake heat is conserved and used to recharge the batteries.

The acceleration and maximum speed of the Equos, and the reuse of braking heat, is roughly comparable to that of General Motor's Impact, which can go from 0 to 60 miles per hour in eight seconds, has a range of 120 miles at 55 miles per hour, and a top speed of close to 100 miles per hour. The Impact uses two electric motors, one placed in each of the front wheels. Nonetheless, the design of the Impact does not include many of the features of the Equos itself, nor of its successor, the maglev car of the 21st century.

The ability of the wheels of the Equos to accomplish a near-80° rotation, compared to those of a normal car which can only rotate 45°, means that steering on the Equos is unique. The Equos design team is also interested in advanced highway designs which would allow the car to run on trolley tracks during highway driving.

I had the fun of driving in one of their prototype Equos battery-run vehicles. The car has many original driving features which are completely unique, as well as an excellent performance. The independently controlled four wheels of the car can be switched into modes in which the four wheels turn in parallel, so that one can slide into a parking place with no need to maneuver. Furthermore, with the front and back wheels placed in opposition to each other, the car can accomplish a very tight U-turn. The test vehicle which I drove was housed in the body of a typical compact car, and had an acceleration on a par with a typical combustion engine car—even on a steep hill.

Since the people at Aisin and Equos are concerned with transmission and related design, they have not experimented with different advanced batteries. They use a regular zinc battery in their present model, and it can travel 260 kilometers (162.5 miles) without recharging at the slow speed of 40 kilometers (25 miles) per hour. Recharging takes about four hours. International research is ongoing with more advanced batteries like the cadmium battery, which runs 1.5 times as long, but is considered to be bad for the health. At the 1991 Tokyo motor show, Nissan featured a battery-run car which could travel for 100 miles without recharging and then only needed 15 minutes to "gas up."

All battery-run cars currently suffer from corrosion, so that not only is the sale-price of the car perhaps double the cost of a comparable compact car of today, but the several-thousand-dollar cost of battery replacement every three years or so must be factored in.

Will the Equos ever go beyond the design state? That is a question which depends upon many more factors than simply its design specifications. It demands the kind of cooperation between American and Japanese automobile manufacturers which characterized an earlier, happier period of relations between the two nations. Most likely, it also requires involvement by the oil majors, which otherwise look at the Equos and all other electric automobiles as competitors that might ultimately render oil an obsolete resource.

Aisin AW was only established in 1969. If the present global depression is reversed, it will be because of an international commitment to rebuild and transform the world's infrastructure. In such a world, we can assume that Aisin will certainly be a corporate giant of the 21st century.

'Smart highways' offer communications advance

There are a variety of programs now being tested in the United States for "smart highways." These Intelligent Vehicle/Highway Systems are fundamentally not transportation systems, but communications systems which allow the automobile to be hooked into a central information system by radio, or to receive signal relays from the roadside of traffic and safety conditions.

Today, 80% of existing traffic signals at urban intersections operate under isolated intersection control. The new systems will allow local transportation officials to monitor traffic conditions and adjust traffic operations, as well as to respond to accidents. This means a more sensitive adjustment of traffic signals and warning signs. Alternate routes can be suggested to individual drivers, which would help to relieve traffic bottlenecks.

Besides receiving safety information, the driver could be given mapping information to help determine the optimal route to a given location. Typically for today's consumer-oriented society, the systems being tested in most states of the United States include information on restaurants, motels, and so on.

There are also systems under design which would warn the driver in advance of an impending collision, and even some which would act to automatically brake a car that was in danger.

Certainly, smart highways are an interesting service to motorists, and they can undoubtedly assist the smooth flow of traffic and so forth, but they are by no means to be considered a substitute for the integrated national transportation system which is needed.