A PROPOSAL ON MASS TRANSPORTATION BY GROUND EFFECT VEHICLE

William R. Bertelsen. M.D.

For Presentation at the International Downtown Executives Association Convention

Chicago, Illinois
September 30, 1960

Air Cushion Vehicles Can Cure City-Suburb Transportation Headaches Says the Inventor of the Aeromobile.

(Dr. William R. Bertelsen, Associate of the Institute of the Aerospace Sciences, demonstrated the Aeromobile at the First Symposium on Ground Effect Phenomena, Princeton University, October 1959, and presented papers on his research and development of a series of man-carrying Aeromobiles for the Princeton Symposium, the Canadian Aeronautical Institute, and the American Society of Agricultural Engineers. In addition to appearing in many technical journals. his work has been reported by The *New York Times*, *1960 Britannica Book of the Year*, *Popular Science, Reader's Digest*, and other publications of general circulation.) An Aeromobile 200 has been purchased by the United States Department of Commerce, Office of International Trade Fairs as an exhibit of American achievement for foreign audiences. It will be demonstrated at the U.S. International Trade Fair, Tokyo, Japan, April 1961.

The ground effect vehicle is a strange and novel device with attributes that promise great possibilities for private and mass travel over rough unprepared terrain and for high speed system design tor mass transportation.

What is a ground effect vehicle? It is the simplest possible powered land vehicle. The Aeromobile is a case in point. It consists of a motor fan which sits in a box with control flaps surrounding it remotely controlled from the driver's seat. This is the entire mechanical system. There are no wheels, tires, axles, transmissions, differentials, etc. Coupled with the great simplicity of the machine is its great versatility in that it is amphibious. It is more amphibious than the usual familiar amphibious vehicle in that it travels over snow, mud, glare ice, open water, mixed water and ice, etc. with equal ease and speed.

The GEV has the mobility of the helicopter in that it moves forward, backward, sideways, diagonally and makes pivot turns. It permits making pivot turns in the driveway and parallel parking by moving sideways between cars.

The Aeromobile provides the smoothest possible ride over rough ground. It is the most reliable vehicle possible because of its few moving parts and extreme simplicity. And for the same reason is the most economical to purchase, maintain and operate.

The Aeromobile and ground effect vehicles in general have tremendous significance for the underdeveloped areas of the world.

The G.E.V. needs neither roads. rails. harbors nor airports. The ancient waterways, the Ganges, the Amazon, the Nile, the Yellow River can become

arteries of rapid and heavy traffic. Only a path is needed through jungle; deserts and the frozen wastes are readily adaptable as thoroughfares. But the most significant promise of the cushion machine is its ideal suitability to a complete new traffic system design wherein safety, speeds, and total traffic can rise perhaps tenfold. The air pressure car will cross water easily and will navigate mud, snow, etc., quickly and surely, but we need more than this to satisfy the suburban traffic crush twice daily, five days weekly. Speed and safety are not found in the disorganized and random operation of any type of vehicle on any medium. There must be provided a line in space and time cleared for every vehicle whether ship, car, plane, train or wheelbarrow.

Now what can the Aeromobile do about it? To explore its potential, forget the wheel was ever invented, and imagine an ideal transportation system. Some of the possibilities will seem fantastic, I will grant (so did space ships ten short years ago), but every mechanical and electronic principle involved is already in use today and available for the devices I propose.

To begin with the simplest improvement, the Aeromobile can free people from bondage to conventional roads. The Aeromobile needs no gravel, no blacktop, no concrete. Suburbs could preserve rural beauty with nothing but broad grassy expanses leading from one town to the next. A clear, fairly level stretch of grass makes the ideal Aeromobile highway. Such highways - literally parkways - would be so cheap to prepare and maintain that a network of them could be spread over enormous areas. The edge-to-edge dimensions of suburbs would increase accordingly and living space would expand by geometrical proportion.

For greater efficiency, speed and safety, a shallow groove offers advantages for the G.E.V., our trial run shows. The Aeromobile tends to center itself in the groove and moves steadily forward at high speed without driver steering. The combination of the cheap groove and the cheap vehicle to follow it opens promising possibilities for the system designer and for buyer, operator and taxpayer.

By carrying the groove highway, or "Aeroduct", into its next logical development, it can be made of corrugated steel or concrete, and elevated to pass over buildings, rivers and pedestrian walks.

As groove speeds rise above 150 m.p.h. the effects of wind and weather become more adverse and it will be better to be protected. The groove is the lower part of a tube and will flow into a circular tube very naturally. A steel pipe laid on the surface, a concrete tube underground, or underwater, an aluminum tube suspended across canyon or river will provide the safest and fastest road ever known.

The grassy groove can be built in a new right-of-way in multilanes preferably, or it could be added down the shoulder and ditch of existing roads

to multiply the facilities. A sixty-four foot right of way with two lanes of concrete (because the taxpayer can not stand any more) can become eight lanes of grassy grooves and concrete, all of which are navigable by the ground vehicle all year, despite snow and ice.

A new eight lane "airway" would be about eighty feet wide in parallel grooves about 18 inches from crest to trough, each lane about ten feet wide, each vehicle eight feet wide or less. Four lanes go north or east, four lanes go south or west. The access lanes are naturally the outer lanes with low speeds. A driver will move to successively faster lanes to the left as his speed rises. The outer lane should be up to 50 m.p.h. Eventually faster lanes can be added. Between north and southbound traffic a short wall and wind break is erected to prevent the disastrous head-on collisions so common now. The wall can be cheap earthen grade planted with grass, trees or hedge. The road is now eight high speed lanes capable of handling approximately a collective 750 m.p.h. by adding the speeds of all eight lanes. In contrast, the more expensive four lane concrete road of the same right-of-way width has a collective 280 m.p.h. at 70 m.p.h. in four lanes.

One must realize that the G.E.V. is an aircraft and that it can go as fast as other aircraft, even through supersonic speeds. The revolutionary difference is that it flies just above the ground, thus gaining almost all the advantages of flight without the danger of flight.

As the volume of vehicles rises over the years as it inevitably will, it will become economically feasible to pump air with the traffic to reduce the power consumption and noise (sonic boom) of the individual car, and to allow it to exceed Mach I or Mach II velocities. Thus a tube trip from New York to San Francisco at 1500 m.p.h. would be two hours duration, and 3000 vehicles could be spaced one mile apart across the U.S.A. and arrive at a rate of 1500 per hour in San Francisco or New York. With four passengers in each car, 12,000 people could traverse the continent every two hours. Such an Aeroduct will be very expensive and could be contemplated only when traffic outgrows the grooves. But the Aeroduct tubes with forced air illustrate the enormous possibilities for growth inherent in Aeroducts and the ever increasing capacity of the system. Clearly no wheeled vehicle will ever reach speeds of rocket sleds but airborne craft do so regularly.

An Aeroduct for extremely high density, high speed traffic with forced air will allow the motorist to cut his engine to fast idle merely to keep the machine airborne and be swept along with the air current. This will save fuel and reduce the amount of exhaust contaminating the tube air. Exhaust will be no great problem, however, with the immense volume of air needed to maintain high velocity in the large tube.

The cars in transit in the super Aeroduct will be swept along in fixed positions and spacing from each other at whatever speed the air is blown, be

it 100 or 1000 m.p.h. There can be no danger of collision of any sort since all traffic including merging traffic moves with its medium, like boats in the Tunnel of Love. Cars could move from one Mach II air stream into another with no sensation to the passengers. The air flow in this long tube will, of necessity, have to be boosted every so many miles by a booster station, very likely nuclear powered.

These "people pipes" can be of any length with or without internal air flow boosters. They can be laid on the ocean floor from the American mainland to Hawaii. across the Bering Sea to the U.S.S.R., from New York to Europe. It should be possible to drive around the world someday.

Aeromobiles open up yet another approach to traffic problems.
The ideas of hands-off driving has titillated inventors since the Curved Dash Runabout and many patents have been issued on various automobile guiding systems using buried cables, radar, or other devices for steering the car automatically. All of these are expensive and fraught with maintenance and other troubles.

The Aeromobile is the only vehicle simple, safe and economical enough for family use that can be designed tor completely automatic operation. The technology of automation is already at our command.

The inherent guidance of the groove for the ground cushion vehicle offers a very inexpensive and reliable sort of automation to drivers. The decision points need only be at the junctions and turn offs, and there only will the electronic gear be located. A black box in the car can be preset, perhaps by dialing, to follow a route through the signals emitted at the junction points. A punched tape, perhaps obtainable from the motor club, will guide the car from coast to coast, if necessary, with a sleeping or reading driver. The car will move from low to high speed lanes automatically and remain in high speed lanes until the coded signals from the junctions tell it to move down for turn off right or left. This process is repeated indefinitely until the car emerges from the automatic system however far this is developed. At first, probably only main arteries will be equipped with automation and the driver will take over at the beginning and end of each trip to take the car through local streets.

It is by no means visionary to conceive that G.E.V. automation will solve the galling parking problem. The driver could go downtown, get out at the office or store and simply send the car home. In this system the owner's garage is also his private parking place. With the high speeds and economical mileage costs of air transit it becomes cheaper to send a car home "deadhead" than to park it. Suburban travel is often twenty to thirty miles which represents only minutes of groove travel. To return home, the owner may call his car to his location in the traffic complex, using an electronic telephone code.

When visiting distant cities it will be logical to obtain automatic parking space locally from hotel, motel, or garage and operate the car in and out of it as needed rather than send it hundreds of miles home.

Only automation can eliminate the dangers of human fallibility, taking over in place of the fatigued, reckless or drinking driver. It provides indefinite motoring privileges for millions of aging drivers.

Compared with our progress in other fields, our transportation system is relatively obsolete. We commonly fly from city to city in less time than it takes us to get home from the airport. The ground effect vehicle is the logical breakthrough from anachronistic travel conditions to a safe, fast and efficient transportation system to keep pace with our scientific age.